VETERINARY MEDICINE

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features in this issue...

Collection of Semen by Electrical Stimulation

Prophylaxis and Therapy in Cerebrospinal Nematodiasis

Rumen Lavage

Clinical Interpretation of Bovine Dental Fluorosis

Longevity of Lyophilized Biological Material

Beta Irradiation in Veterinary Ophthalmology

Systemic Mycoses in Dogs

Response of Kittens to Newcastle Disease Virus

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Plum Island Laboratory at Work

Plum Island, an isolated bit of land off the northeastern tip of Long Island, is the site of new research on vesicular diseases of livestock. Existing facilities there turned over to the USDA by the army have been completely rebuilt for laboratory purposes. Intensive studies planned and begun this summer are almost two years ahead of schedule.

Initial work is concerned with the virus of vesicular stomatitis. One phase of studies on foot-and-mouth disease is scheduled to commence immediately.

Construction of the main laboratory on this island of approximately 800 acres (3 miles long and 1 mile wide) also was begun this summer and will be completed January, 1956.

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Hormone Treatment Evident in Some Market Cattle

An experienced cattle buyer at the Kansas City Stockyards answered promptly when asked if he could pick out hormone-treated fat cattle. "Sure", he said, "There is no mistaking the reason for that characteristic high tail, and conformation (fat deposit) over rump and shoulders." Cattle buyers practice caution, and are watching "cooler shrink" figures and laboratory test reports on these animals as to comparative meat texture and quality.

Caution is recommended. Watch farm and nutrition reports. Some unknown factors need explanation before giving blanket endorsement to hormone treatment.

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Necrology XLVI

Some Observations In Collection Of Semen From Bulls, Goats, Boars And Rams By Electrical Stimulation

P. J. DZIUK,* B.S., M.S., E. F. GRAHAM,* B.S., M.S., J. D. DONKER,** B.S., Ph.D., G. B. MARION,† B.S., M.S., Ph.D., and W. E. PETERSEN,* B.S., M.S., Ph.D.

With increased emphasis on problems of fertility and sterility and greater application of artificial insemination, it has become increasingly important to be able to obtain semen from males of the domestic species under a wider variety of conditions than is now the case. Some males are either unwilling or unable to serve an artificial vagina or to yield semen by other usual means of collection for artificial insemination or critical study.

Gunn[3] was one of the first to collect semen from any domestic species by electroejaculation. He utilized 60 cycle current of about 30 volts applied by means of a rectal probe and a lumbar probe. He worked primarily with rams. Bonadonna,[4] Lambers, and McKenzie,[5] Terrill[6] and others made further applications and tests of this technic. A modification restricting the stimulus to one rectal bipolar electrode was developed by Laplaud and Cassou[8]. Further use of this bipolar electrode was made on rams by Laurans and Clement,[9] Likar and Kamhi,[7] Mata and Cano,[9] and Ortavant *et al.*[9]

This same type of bipolar probe was modified so as to work with the bull by Thibault *et al.*,[10] Laplaud *et al.*,[11] Laplaud and Cassou[12], Lutwak-Mann and Rowson,[13] and Dziuk *et al.*,[14] made use of this technic both for experimental work and practical application in bulls. The following described trials were conducted in an attempt to work out the best procedures in those species to which the electroejaculation technic has already been applied by certain experimental methods and practical applications, and also to develop the technic in previously untried species.

Experimental Procedure

The electrical stimulus was produced by the same equipment in all cases. The only difference between species was the size of the rectal probe. The source of stimulus was 110 volt 60 cycle current which was reduced to 30 volts by a transformer which also isolates the electrodes from the line source. A variable transformer makes possible gradual changes in the voltage applied to the probe. Rectal probes were made of stiff rubber hose. The electrodes were solid core solder rings partially inlaid in the rubber hose. Each electrode was connected to the outside by a separate lead. Alternate electrodes were connected together to the source of stimulus so that there was a difference in electrical potential between ad-

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jacent electrodes. The dimensions of the rectal probe used for the bull were as follows: 1½ in. in diameter, six rings 1¾ in. apart; for the boar 1 in. diameter with seven rings 1⅛ in. apart. The same size probe was used for rams and goats—¾ in. diameter with six rings 1 in. apart. The technic was identical in all cases.

Animals were given an enema of warm 3 to 5% common salt solution. The probe was lightly lubricated with some noninsulating lubricant and inserted so that the last ring was just inside the anus. The probe was maintained on the ventral side of the rectum. Voltage was gradually increased and then reduced again to zero over a five-second period followed by about five seconds of no stimulus. The stimulus was repeated and the voltage level of each succeeding one gradually increased until semen was obtained. There is much variation in the response between individuals and even from one collection to another in the same animal. A certain amount of experience is necessary to achieve consistent results.

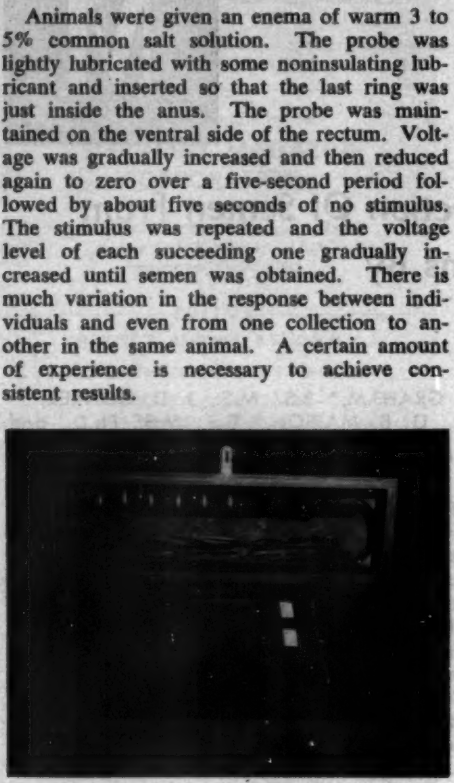

Fig. 1. Electric probe, wiring, and transformer fit into a convenient carrying case. Set is attached to 110 volt circuit.

Forty-eight rams were used in these trials. Forty-two were of mixed breeding and unknown history. They were used while in a local stockyards. Four of the rams were from the station breeding flock and two were experimental animals of the Veterinary Anatomy Department. Six boars were used while in the stockyards and were of mixed breeding with unknown histories. Four Minnesota No. 1 boars from the station breeding herd also were used. A single goat was used, an aged buck from the Veterinary Anatomy Experimental herd. One two-year old Holstein bull from the station experimental herd was used in one experiment.

Results and Discussion

Generally an erection may be obtained with relatively low voltage and current while ejaculation requires a level of about 10-15 volts and a current of 0.5 to 1 ampere. Erection occurs most often if there is a higher number of stimulations at a sub-ejaculatory level. Good contact between the electrodes and the rectal mucosa is essential. This necessitates an enema which is adequate to remove most of the rectal contents that tend to insulate and so reduce the effectiveness of the stimulus.

Rams and the goat, in these experiments, required only about three stimulations of 2-, 5-, and 8-volt peaks respectively, in order to obtain ejaculation. The current would reach 0.5 to 1 ampere at this time depending on the degree of contact achieved in the rectum. If the voltage peaks were kept at the 1- to 2-volt level for a large number of stimulations or if there was an accumulation of feces to insulate the electrodes and reduce the effective voltage, erection would precede ejaculation. Collection was done in most cases by slipping a rubber cone with a test tube over the end of the sheath so when the penis protruded even a slight amount, it was sufficient to obtain clean semen. Rams were restrained in most cases merely by heading them into a corner of a pen and straddling the neck while grasping behind the front legs. A second man collected the semen and controlled the stimulation, while a third held the rectal probe. In this way, it was possible to collect from many rams in a relatively short period. This would make possible evaluation of a large number of rams for sperm-producing ability before turning them with the breeding flock. Fifty collections were made from rams. Of the 48 rams evaluated, four had no sperm or no live sperm. The percentage motile sperm ranged from zero to 90 with an average of 55%. The density ranged from low to high as evaluated microscopically. Volume of those samples measured, varied from 0.5 to 8 cc. with an average of 1.7 cc. per collection. Two collections of semen were made from a single goat. The volume of the collections was 2 and 4 cc. respectively. The density was high and it was estimated that 70% of the sperm were motile in both cases.

Only enough semen was collected for examination under the microscope, in some cases, so that percentage motility ratings were the only evaluations made. Generally, as judged by microscopic examination, semen obtained was less dense, but was of higher volume than an ejaculate obtained by usual methods, so that

about the same total number of spermatozoa resulted. It was observed that fluid secretion continued as long as stimulations continued, but density of each collection decreased to the point where fluids were nearly sperm free. One ram was anesthetized with dial® and urethane and, while completely anesthetized, electroejaculated. One ml. of normal semen was obtained. Eight hours later, while still completely anesthetized, and following transection of all the dorsal rootlets from the sixth lumbar nerve posteriorly, the ram was again ejaculated by electrical stimulus and 1 ml. of normal semen obtained. Transection of one pudendal nerve did not alter the reactions or the semen obtained from another ram. In one instance, a bull was given an epidural anesthetic prior to collection. Anesthesia did not appear to influence ejaculation or semen in any way. There was, however, less tendency for extension of the hind legs. A higher voltage was necessary to achieve ejaculation in the case of boars than with rams. This may be due to the larger accumulation of fat which insulates the nerves from the electrodes, since it was generally observed in all species that thin animals were much more sensitive to electrical stimulus than were those in high condition. Usually it also required a larger number of stimuli in the case of boars, so that a total of about ten were necessary for ejaculation. The voltage peaks of the final stimulus ranged from 12-17 volts.

Boars were restrained by one of two methods, either they were held by a nose loop which was tied to a corner of the pen or they were squeezed between a gate and the adjacent side of the pen. The latter method was not satisfactorily since boars always tend to back up.

Ten collections were made from boars. There was marked absence of excess accessory secretion and usually only one or two of the thick tapioca-like pellets were obtained. The semen did not coagulate and sperm were quite dense to the extent that the semen appeared milky and swirling motion could be observed microscopically. The average volume of semen obtained in these trials was 4.1 cc. with a range of 1 to 8 cc. The motility estimates varied from zero to 85% motile sperm with an average of 46%.

No attempt was made to collect large volumes, but only enough to evaluate microscopically.

In no case with any of the species used were there and detectable, adverse, physiological effects or unfavorable associations from the use of this technic. In some cases, with both boars and rams, there was an increased sexual desire following electroejaculation. This was evidenced by attempts to mount male penmates. They had not shown this type of activity while in the same pen with the same animals only a few minutes previously.

Summary

Electroejaculation makes possible collection of semen from domestic animals under difficult, if not impossible conditions that preclude collection by usual methods. There do not appear to be any adverse effects on either the semen so collected, or on the animals used. Electroejaculation may be a supplement to usual methods of collection of semen both for experimental work and in the practical application of artificial insemination.

Acknowledgment

Acknowledgment is made to Dr. R. L. Kitchell of the Veterinary Anatomy Division, School of Veterinary Medicine, University of Minnesota, for his cooperation in making certain animal preparations available for some of

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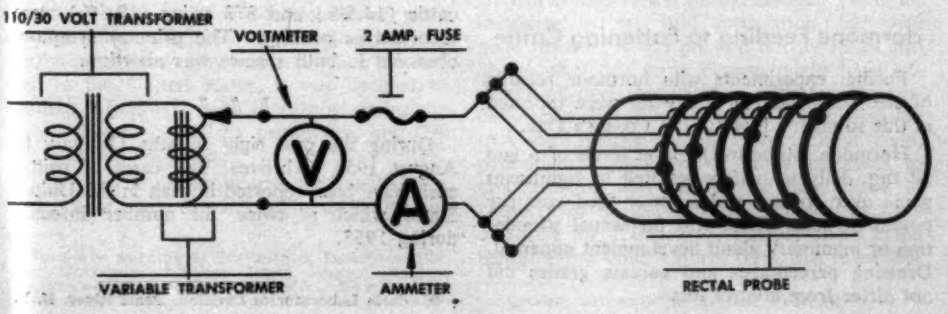
Fig. 2. Schematic drawing illustrating wiring diagram and essential elements of the electric probe.



the trials; to Dr. W. E. Rempel of the Animal Husbandry Department and Norris K. Carnes of Central Livestock Association for making animals available for study.

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▼ ▼ ▼

Hormone Feeding to Fattening Cattle

Further experiments with hormone feeding of steers and heifers in dry lot were reported at this summer's Iowa Cattle Feeder's Day.

Hormone (stilbestrol) fed at levels of 6 and 12 mg. daily to heifers resulted in significant gains over control and a lower feed cost per pound of gain. There was no sexual stimulation or mammary gland development apparent. Dressing percentages and carcass grades did not differ from control lots.

Effect of Antibiotics on Ruminants

The effect of antibiotics on ruminants would be expected to differ from that observed in monogastric animals. In the ruminant, nutrition depends basically upon bacterial synthesis. However, numerous studies have illustrated that the administration of small amounts (15 to 100 mg. daily), of broad spectrum antibiotics to young, nonruminating calves increases growth rate, decreases diarrhea, and generally improves physical appearance. In experiments conducted by Rusoff (*Jour. An. Sci.*, 9:666, 1950) 30% growth response was obtained by feeding aureomycin® to 14-week-old calves during a short feeding period. Other researchers have reported similar results, and Fincham fed antibiotics to experimental calves from four days to over two years of age without apparent digestive disturbance.

Little is known regarding the actual mechanisms involved in growth stimulation. Three possibilities are suggested by Stokstad (*Phy. Rev.* 34:26 [Jan.], 1954): (1) Increased bacterial synthesis of essential or stimulating growth factors, (2) inhibits bacteria which compete with the host animal for nutrients, and (3) inhibition of organisms that produce toxic compounds (selective inhibition). Whatever the factors, it remains for further experiment to explain antibiotic growth stimulation, and if direct, when fed young cattle.

▼ ▼ ▼

Leptospirosis in Cattle and Swine in Illinois

Results based on positive serum agglutination-lysis tests extending over the period January 1952 through May 1954 are reported by the College of Veterinary Medicine, University of Illinois.

A total of 23,023 cattle and 4,518 swine in 2,153 herds and 575 droves were tested; 3,337 cattle (14.5%) and 878 swine (19.5%) were recorded as positive. The primary symptom observed in both species was abortion.

▼ ▼ ▼

During the past eight months (January to August 1954 inclusive), 389 cases of psittacosis have been reported in man in the United States which is twice the number infected during 1953.

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Prophylaxis And Therapy In Epizootic Cerebrospinal Nematodiasis Of Animals By 1-Diethylcarbamyl-4-Methyl-Piperazine Dihydrogen Citrate: Report Of A Second Field Trial

CHUSABURO SHOHO,* D.V.M., Dip. Agric. (vet)

CEREBROSPINAL nematodiasis of sheep, goats, and horses has been defined clearly, so far beyond dispute, geographically to occur only in Japan, Korea, Ceylon (but now possibly India), although many other repercussions have arisen from this work regarding its possible occurrence in domestic animals all over the globe. The name was given by Innes and Shoho[1,2] to designate a form of acute or sub-acute seasonal neuroparalysis, caused by insect-transmitted helminthic larvae of *Setaria digitata*, with the subsequent wandering and development of the larvae from the cutaneous site to their emergence as young worms in the central nervous system. The main thesis regarding etiology by nematodes arose, originally, by investigations of Japanese workers of the Korean Research Committee on Ovine Lumbar Paralysis[3]. All references, and due credit, to this work are covered fully in the paper by Innes and Shoho. The disease was defined as a focal form of encephalospinal malacia, with some concomitant degree of eosinophilic meningitis, and simply caused by the mechanical trauma of a worm burrowing in brain or cord. Clinically, the severity might range from some cases which are totally silent, to others with motor weakness and mild incoordination with recovery, and yet to others with acute and fatal paralysis. Subsequently, at the suggestion of Doctor Sasa (Institute of Infectious Diseases, Tokyo) because of work on the new filaricide, 1-diethylcarbamyl-4-methyl-piperazine dihydrogen citrate, discovered in the United States, it was decided to conduct a field trial with this drug against the animal disease caused by nematodes, and this was reported by Shoho[4].

This present paper records the results of a further trial made in 1953. The difficulties of carrying out chemotherapeutic trials on such a nematodal nervous disease were emphasized before, merely because of the complexities attached to accurate diagnosis on clinical grounds alone; in fact faultless diagnosis might be impossible without meticulous pathological examinations. Nevertheless, bearing in mind all facts of the nature of the condition, which have been fully discussed by Innes and Shoho,[1] there seemed to be clear indications that this drug (commonly known as caricide®) could be the key to chemotherapeutic control of this disease. If this were so, it becomes of some major importance, for the disease is not simply a sporadic one of academic importance, but occurs seasonally every year, and in somewhat epizootic proportions in the Far East and in Ceylon. There are other implications arising from a consideration of the disease. Without indulging in any wild speculation, but with good reasons, it was pointed out by Innes and Shoho, that this same disease might have occurred all over the world in different domesticated animals (and even man), but has evaded true identification simply from lack of good, pathologic examinations. Some emphasis in this direction was paid to the possibilities of "kumri" in horses in India (known to have occurred for 150 years), Burma, and Ceylon being of the same nature; from this there was

Japanese workers have demonstrated rather conclusively a complex traumatic encephalomyelomalacia caused by migration of parasitic larva. Attention was directed to this work by Dr. O. A. Foster (Vet. Med., 46:126 [Mar.], 1954). Dr. J. R. M. Innes (Vet, Med., 46:192 [May], 1951) also made brief summary for readers of a rather substantial quantity of research performed by a number of researchers and by himself. For those interested in further details, reference should be made to the full paper by Innes, J. R. M., Shoho, C., and Pillai, C. P., Cerebrospinal Nematodiasis or Setariasis. Brit. Vet. Jour., 108:71, 1952.

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a clear indication for further work on so-called "wobblers" of Thoroughbred horses in this country. If these speculative concepts were clarified, the solution to control of the disease might lie readily at hand in the form of caricide. Thus it is of interest that Perumal Pillai, and Innes[4] recently have identified both worms and malacic lesions in the spinal cord of an equine paralytic case (kumri) in Ceylon.

Field Experiment and Methods

Prophylactic Trial. In the previous trial (1951) a total of five cases occurred among 633 treated sheep, given a single oral dose of 20-40 mg./kg. of body weight of the drug, and observed for a period of three weeks thereafter from the date of dosing. There were more than 21 cases in the control group of 1,339 untreated sheep within the same period. In the present trial, a single oral dose of 40 mg./kg. of body weight of caricide was given on a preventive basis, repeated in 20 days, and between 80-100 mg./kg. per lb. of body weight was given for therapeutic work. The drug was dissolved in an adequate quantity of water, and given by stomach tube. Rapid absorption occurs from the ruminant stomach, for a filaricidal action on the microfilaria of *S. digitata* in cattle can be noted within three hours after dosing.

The trials were made in five villages. On the first dates, given in the table, sheep selected for treatment were given one dose of drug and then observed for onset of nervous signs during the next three weeks; a second dose of caricide was given, and animals observed for another three weeks. This period (August-September) would represent the normal seasonal peak period of incidence of the natural disease. Most of the untreated sheep were observed for the whole period of six weeks, but were counted separately for each experimental three weeks. The results are appended in Table 1.

Comment

The results confirm those of the previous trial (1952), and are perhaps more impressive, because, in effect, the untreated group was used for observation twice over two three-week periods. The incidence in the untreated group during the six-week period, in reality, would be over 10%, compared with less than 1% in

TABLE 1

Village	Trial	Date of Trial	Number of Sheep Treated	Cases	Untreated	Cases
Mutsuai (Manshoji)	I.	Aug. 24	33	0	40	4
	II.	Sept. 16	28	0	40	
		Total	61	0	80	4
Hygashiyuno	I.	Aug. 31	62	0	0	0
	II.	Sept. 21	55	0	7	0
		Total	117	0	7	0
Handa (Shimotakaya)	I.	Aug. 30	26	0	174	12 (+x)
	II.	Sept. 20	20	0	180	
		Total	46	0	354	12 (+x)
Danzaki (Only lambs)	I.	Sept. 6	9	0	241	21 (+x)
	II.	Sept. 26	8	0	242	
		Total	17	0	483	21 (+x)
Kakeda	I.	Sept. 2	32	2	58	14
	II.	Sept. 19	31	0	58	
(Independent small group)		Sept. 8	4	0	0	0
		Total	67	2	116	14
		Grand Total	308	2	1040	51

Legend for cut opposite page

Fig. 1A. Sheep, therapeutic trial, Case 1. Photo taken on Sept. 2, 1953, showing paralysis of left ear, possibly associated with lesion in upper cervical cord or nerve roots of that region.

Fig. 1B. Same animal three days after treatment with caricide showing definite recovery in nervous control of ear muscles.

Fig. 2A. Goat, threapeutic trial. Photo taken Sept. 3, showing the animal unable to use the right hind leg, carrying it forward.

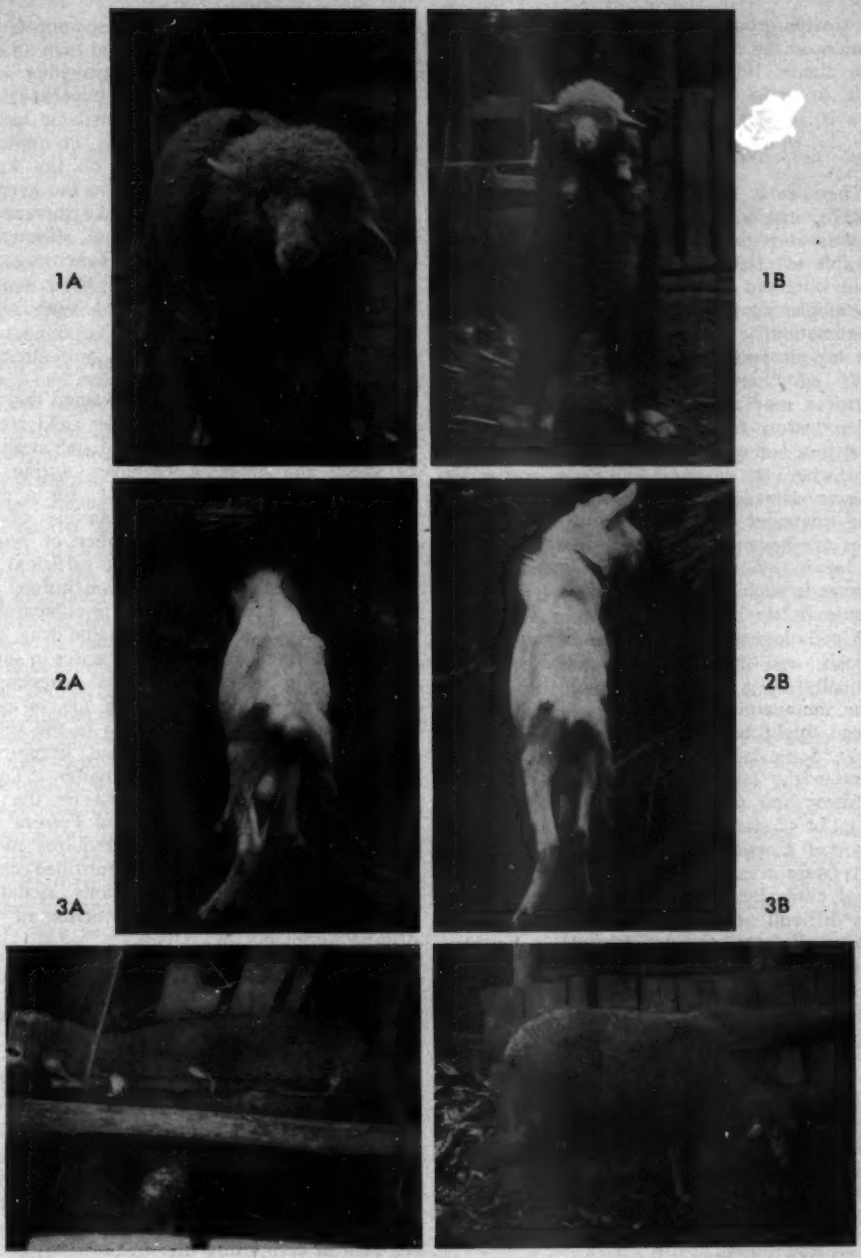

Fig. 2B. Same animal nine days after treatment with caricide; the leg is firmly placed on the ground, although some wasting of muscles is still discernible.

Fig. 3A. Sheep, therapeutic trial, Case 24. Photo taken Sept. 5, showing the animal suspended in a sling, unable to stand or walk properly. This method of treatment is used commonly in Japan, for very mild cases may recover if supported and nursed properly.

Fig. 3B. Same animal taken three days after dosing with caricide, although with its head still hanging, it was able to stand firmly on its feet without support.

the treated group. We still require more information on the maximum, tolerated dose which give almost 100% protection. It is not possible to make comparisons between efficacy of a 20 mg./kg. dose as used in the first trial (1952), with the 40 mg./kg. dose used in this one.

Therapeutic Trials. In the previous report (1952), and in papers by Innes and Shoho, reasons were given to explain why it might be possible to effect cure by filaricidal drugs in cases observed at an early stage with mild, neurologic signs of motor weakness and incoordination, *e.g.* weakness and carrying of one leg, dropped ear and so on, without true acute paralysis (see figs. 1-3). The causal worm(s) may cause meningeal and radicular inflammation and irritation, without, or before, proceeding to burrow into the brain or cord, where the worm(s) can cause irreparable malacic damage, and for which possibly no drug treatment ever would be effective. Early cases are known to have occurred in animals in Japan. Accurate clinical assessment of damage in such cases would be impossible, yet if animals do show nervous signs associated with pathologically-proven cerebrospinal nematodiasis, and such signs are obliterated dramatically by a filaricidal drug, then surely some therapeutic conclusion is justified (and indeed might be an additional diagnostic index). Some indications in this direction were given in the 1952 report covering a total of 64 sheep and four goats. In the 1953 trial, a total of 42 sheep (descendants of the original imported Corriedale breed) and 10 Saanen goats were treated, all of which were diagnosed, clinically, as cerebrospinal nematodiasis. It is difficult, under any circumstances, to illustrate clinical signs of a neurologic disorder of the lower animals, but figures are given which may depict, visually, some therapeutic effects of the drugs (fig. 1-3). The table of treatments is given in Table 2.

TABLE 2

40 mg./kg.	Once	to	1	sheep	
"	Twice	"			to 2 goats
50 mg./kg.	Once	"	5	"	
"	Twice	"	3	"	
60 mg./kg.	Once	"	24	"	to 6 goats
"	Twice	"	7	"	" 2 "
"	Thrice	"	1	"	
100 mg./kg.	Once	"	1	"	
			42	sheep	10 goats

In 29 sheep and seven goats recovery was prompt and evident within a few days of treatment, independent of dosage and number of doses of drug given. Two sheep died on the day following treatment, but these animals had been much more severely affected than all others, with inability to stand, struggling in a prone position; from previous experience, in these cases cerebral or spinal malacic lesions would be found. In the remainder, no improvement was noted, but we still do not know whether the volume of damage to the nervous system in such cases might make therapeutic medication hopeless and valueless, although it might kill the caual worm (s). Taken together with the results of the first trial, there is good indication for further controlled work along similar lines.

General Conclusion

Further evidence has been obtained that the drug (caricide) is effective under field conditions in preventing cerebrospinal nematodiasis of sheep and goats, when given during the appropriate season of incidence, for a period of three weeks after a dosage of 40 mg./kg. by mouth. The number of horses treated in the same way is not sufficient, as yet, to permit of any similar conclusion, but this might be expected. There is comparable, good, clinical evidence that the same drug, at a higher dose level, will cure many cases in sheep and goats, in which, by clinical assessment, neural damage is not too severe, *i.e.*, in cases where worms may be wandering in the spinal canal, but had not yet caused irreparable lesions in the grey or white matter. These results are somewhat confirmed by the recent work of Perumal Pillai and Perrera[2] on goats in Ceylon. The work requires much more extension on a larger, controlled scale, and from many different directions, including studies on the pharmacological action of the drug in ruminants and horses.

Acknowldegements

Thanks are due to Dr. A. Zink, Lederle Laboratories, New York, and Mr. R. C. Scott, Lederle Laboratories, Tokyo, for their generous help and supplies of caricide. The field trial was made possible by cooperation of Mr. D. Hyata, President of Local Corporation of Animal Husbandry, Date, Fukushima. My thanks are also due Dr. J. R. M. Innes, Chief of Pathology, Medical Laboratories Army Chemical Center, Edgewood, Maryland for help in composing the report.

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(Continued on page 464)

Rumen Lavage

W. D. POUNDEN,* D.V.M., Wooster, Ohio

LAVAGE has considerable merit when corrective measures are required for the presence of abnormal material or undesirable fermentations in the rumen. It is, to some extent, comparable to cleaning out a cheese vat or some other fermentation vat where gross contamination, with undersirable microorganisms, has occurred or faulty materials have entered, resulting in worthless products.

The origin of the procedure of rumen irrigation by means of stomach tubes is not definite. Kingman[2], who did much to stimulate its use through his teaching and writings, credited the late Dr. R. N. McCarroll of Ft. Collins, Colorado with having brought the technic to his attention. It is possible that the idea originated with Doctor McCarroll. Begg[1] in 1915, in discussing diseases of the digestive system in cattle, mentions that "American practitioners habitually practiced, and with good results, irrigation of the rumen with large quantities of water, by means of a stomach tube." It is to Doctor Wiepers, presently dean of Glasgow Veterinary College, Scotland, to whom I am indebted for having brought this reference to my attention.

Indications for lavage can be defined more precisely when sampling is used as a diagnostic aid[3]. Furthermore the therapy or procedures needed to support this remedial measure properly have become clarified as additional information has become available on rumen function and dysfunction.

Technic

Passage of stomach tubes into cattle and the collection of rumen samples has been discussed in some detail[3]. As Kingman[2] described the lavage operation, warm water is used to fill the rumen after any quantity of free gas present is removed. Warm water only should be used to avoid the risk of chilling or shocking an animal with a large volume of cold water. Stomach pumps, funnels, or when possible, direct connection to a water hose may be used to accomplish the filling. Our preference is one of the latter two. To quote Kingman, "Fill the rumen until it is well distended, lower the head of the animal, turn the tube so that its end will be pointed downward and proceed to pump out the fluid contents. By pumping is meant that the tube is "pumped" back and forth in such manner that plugs of ingesta will be flushed along toward the outside. When the fluid contents have been evacuated, refill and repeat the operation until a sufficient quantity has been removed to insure the safety of the patient."

When the rumen is relatively full, only limited quantities of water can be put in at first before permitting some to flow back out or be forced out by the back and forth pumping action of the tube. The more fluid the mass becomes, the easier it is to remove. Consequently, difficulties are experienced in recovering large quantities early in the treatment. It is best merely to remove what comes relatively easy. Once the contents become fairly fluid in consistency they flow rapidly out of the tube under rumen and abdominal contraction.

On occasions, when quantities of water were infused into the rumens of young stock being used for experimental purposes and not in need of lavage, water appeared to pass rather easily into the abomasum. No harm resulted, but it would be advisable to avoid this occurring because of the possible risk of upsetting the function of this organ.

Indications for Use

Repeated filling and removal of contents until the returning liquids are fairly clear is in order when visibly abnormal materials are present. On the other hand, a limited lavage may be all that is necessary to produce results by diluting and removing soluble toxic substances when these are responsible for illness. Fortunately, the removal of coarse roughage material is seldom necessary. Types of cases that may be expected to receive benefit from a limited lavage were mentioned in the discussion of rumen sampling[3]. They concerned a cow whose rumen ingesta appeared quite normal but evidently contained toxic substances, and a calf that had overeaten on forage-crop silage to which it was not accustomed. In both cases, the animals recovered speedily following treatment. An inoculation with fresh rumen contents was pro-

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vided the calf because, on microscopic examination, an abnormal microflora was present and a serious lack of normal varieties existed.

Visibly abnormal contents, sometimes in a frothy, foul-smelling condition containing grain, chaff, bedding, drugs, and even dirt may well be removed almost entirely. The calf that had engorged on corn and cob meal, and the heifer that had been pushed excessively on grain feeding in preparation for showing[2] provide instances where this treatment was indicated. Animals that have been slow to recover from acetonemia and have eaten practically nothing except a little grain, bedding, and dirt, sometimes are candidates for fairly complete lavage. It is rather futile to expect speedy recovery without most of the abnormal ingesta being removed. Supporting procedures include provision of good quality roughage and rumen inoculations with fresh rumen contents. The latter preferably should be repeated during the following few days. As a safety precaution, the quantity of feed available should be limited to avoid ingestion of more than the amount with which the inoculum present can cope.

The presence of a sour-smelling mass of milk curd in the rumen of a calf generally indicates gastritis. The cause of the latter must, of course, be removed and treatment provided, but in addition it is advisable to remove much of the abnormal rumen contents. Similar supporting procedures as mentioned previously are advisable. In limited trials with young calves it has appeared that cud material, including the solid ingesta, placed in their mouths has been preferable, particularly when repeated a few times at daily intervals, to infusing liquid rumen contents.

A logical means for correcting the presence of fibrous masses that are not being digested, for example fiber balls in young calves or a mass of corn husk fibers such as was suspected to be the cause of repeated attacks of bloat in a young steer[3], is to provide excellent conditions for fiber digestion. This formed the basis for the treatment given which proved successful. The steer was given a lavage to remove much of the grain, good quality hay was provided and a generous inoculation with fresh rumen contents from an animal on a high roughage ration. A week later the animal was returned to the fattening ration and suffered no further trouble.

The provision of suitable, good quality roughage with but limited quantities of grain and administration of rumen inoculations are supportive measures following rumen lavage that frequently make the difference between success and failure. Without the ingestion of proper feed to support desirable rumen microorganisms, or without adequate numbers and varieties there is a risk that a relapse will occur. Fresh rumen contents of freshly obtained cuds from healthy stock should be relied upon for inoculating purposes. A trial with frozen rumen juice and some of the available commercial products suggested for this purpose indicated that some were incapable of providing adequate inoculation of calves eating diets composed, to a great extent, of roughage[4]. As this kind of diet is similar to the rations fed mature stock, there is reason to believe that these products would not serve as adequate substitutes in the case of mature animals when this therapy is needed.

A decision between attempting rumen lavage or doing a rumenotomy must be made on occasion. In general, it is difficult to accomplish a lavage in an animal that is unable to stand up. Sometimes, however, a calf that is too weak to stand alone can be given enough manual support to permit carrying out the operation. Feed-lot steers that have eaten excessively of grain generally have responded well to lavage, especially when treated early, and have returned promptly to full feed. On the other hand, dairy cows that have become severely toxic and weak from a similar experience have not always done as well, particularly where some delay in treatment occurred, and thus rumenotomy may be preferable.

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Cerebral Nematodiasis

(Continued from page 462)

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A Classification For The Clinical Interpretation Of Bovine Dental Fluorosis

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LACK of an acceptable classification for the evaluation of injury to bovine teeth induced by fluoride toxicity is responsible for a considerable amount of misunderstanding and differences of opinion among investigators. Such a classification would simplify recording of, and reporting, experimental and field data.

The teeth of cattle fed definite quantities of fluoride (as sodium fluoride) and the teeth of cattle affected by grazing pastures contaminated with the toxic agent, which was emitted by industrial operations, were carefully studied for a period of approximately three and a half years**. The teeth of privately-owned cattle reared in the vicinity of industrial plants which were reported to emit fluorine also were observed. These animals were subject to a considerable variation in management, nutrition, et cetera. Observations of the former two groups were made at one-, two-, or three-month intervals as conditions and developments indicated. Observations at these frequent intervals permitted the study and description of the continuity of progressive dental changes. The rapidity of progression of several types of lesions necessitated these short interval observations. At least three pair of incisors, the premolar and third molar teeth were observed from the time of eruption to and including functional phases. The proposed classification is based upon the data accumulated through these studies.

The descriptive terminology assembled and used in indicating the various types of tooth changes during this period will be published as a joint contribution of the Universities of Tennessee, Wisconsin, and Purdue.

The effect of fluorides upon bovine teeth may be divided conveniently into five groups: (1) Possibly affected, (2) slightly affected, (3) moderately affected, (4) moderately-severely affected, and (5) severely affected. The dental changes considered to be characteristic of the five groups are presented in summarized and detailed forms.

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Summarized Form

1. *Possibly Affected.* Incisor teeth: Slight opaqueness, focal chalkiness, focal yellowish-brown staining of enamel, occurring singly or in combination.

2. *Slightly Affected.* Incisor teeth: Moderat opaqueness, focal chalkiness, forcal or diffused yellowish-brown staining, carious and/or superficial erosions, and slight hypoplasia of enamel.

3. *Moderately Affected.* Incisor teeth: Moderate opaqueness and/or focal chalkiness, focal or diffuse brown staining, progressive carious foci and superficial or deep erosive lesions, moderate, progressive hypoplasia of the enamel, and moderate tooth hypoplasia with tooth spacing. Premolar teeth: Enamel and cementum yellowish-brown stained, carious foci, focal hypoplasia, and moderately heavy wear. Molar teeth: Moderate wear (M1,2), cementum brown to black stained, moderately heavy wear (M3V** and D*), long, pointed projection (M3V).

4. *Moderately-severely Affected.* Incisor teeth: Enamel focally or diffusely brown stained, moderate to marked carious and erosive lesions, moderate plus hypoplasia, enamel uniformly olive stained, chalky stippled, moderate plus tooth hypoplasia, wider tooth spacing, abnormal tooth inclination. Premolar teeth: Enamel and cementum brown to black stained, focal caries, focal hypoplasia, moderately heavy to heavy wear, and tooth hypoplasia (simple). Molar teeth: Moderate wear (M1,2), "gouged" (M2D), black stained, tooth hypoplasia (M3), wear superior to gingivae (M3D), moderately heavy wear, long, pointed projection (M3V).

5. *Severely Affected.* Incisor teeth: Extensive erosive lesions and black staining, marked to extensive hypoplasia of enamel, enamel uni-

*D—refers to maxillary teeth.
**V—refers to mandibular teeth.

formly olive stained, chalky stippled, marked to extensive tooth hypoplasia, pronounced tooth spacing, imperfect or faulty enamel-dentin union, eruption lingual or labial to dental arch, delayed or irregular, abnormal inclination. Premolar teeth: Enamel and cementum brown to black stained, focal caries, focal hypoplasia, heavy wear, moderate to marked tooth hypoplasia (simple). Molar teeth: Moderate to moderately heavy wear (M1,2), "gouged", long, black stained spicule at posterior pole (M2D), black stained, wear superior to gingivae (M3D), long, black stained projection, moderately heavy to heavy wear, hypoplasia of cementum (M3V), irregularity of attritional surfaces, tooth hypoplasia (simple, incomplete formation, anodontia).

Detailed Form

1. *Possibly Affected.* Incisor teeth: Slight loss of luster or slight opaqueness of enamel, moderate focal chalkiness, with or without opaqueness, focal yellowish-brown to brown intraenamel staining or mottling, which may occur as transverse bands or vertical striae. Premolar teeth: No gross changes. Molar teeth: No gross changes.

2. *Slightly Affected.* Incisor teeth: Enamel partially or entirely opaque, moderate focal chalkiness (progressive increase in successive eruptions); yellowish-brown to brown focal or moderately diffuse intraenamel staining or mottling; brown or black stained carious foci and/or superficial erosions; and slight focal enamel hypoplasia (pitting or foveae, usually confined to the lateral and corner teeth). Premolar teeth: No gross changes. Molar teeth: No gross changes.

3. *Moderately Affected.* Incisor teeth: Enamel moderately opaque, focal chalkiness, focal or diffuse brown intraenamel staining, brown to black stained progressive carious foci, moderate to marked superficial or deep brown to black stained enamel erosions (mechanical or traumatic abrasions usually become carious); moderate enamel hypoplasia (focal type in center, and/or intermediate, patchy type in intermediate, lateral, and corner teeth), and moderate tooth hypoplasia (usually lateral and corner teeth) with resultant wider spacing of teeth. Premolar teeth: Lingual, labial, and attritional surfaces (exclusive of the firmly adherent black or metallic calculus normally observed on the gingival third or half) yellowish-brown stained, black stained focal caries of enamel and/or cementum, focal hypoplasia of enamel and cementum; and moderate to moderately heavy wear. Molar teeth: Moderate, even wear (M1,2V), moderate wear, posterior third "gouged" (M2D); focal hypoplasia and brown-black staining of the cementum; moderately heavy wear (M3D); moderate plus lateral shear wear of anterior third, center or posterior third long and pointed (M3V).

4. *Moderately-Severely Affected.* Incisor teeth: Enamel focally or diffusely brown stained (center, intermediate teeth,), or enamel uniformly olive stained (usually lateral and corner, occasionally intermediate teeth); moderate to marked carious and erosive enamel lesions with residual enamel and/or dentin brown to black stained (center, less frquently intermediate teeth); small, irregular, roughened, grayish-white calcific elevations "chalky stippled," of enamel; moderate plus enamel hypoplasia (center focal or patchy type, intermediate usually patchy type, lateral and corner shell type); moderate plus tooth hypoplasia, tooth spacing more apparent and occurring earlier in the dentition sequence (slight hypoplasia of intermediate, quite apparent in lateral and corner teeth); occasionally vertical grooves (approximal wear) worn in the defective enamel of permanent teeth by deciduous teeth which were retained for an extended period (these grooves usually become carious); erosions at medial and lateral appositional aspects of teeth initiated by approximal wear; teeth abnormally loose in alveoli; and slight to moderate inclination abnormality (especially lateral and corner teeth). Premolar teeth: Slight to moderate (PM1D), moderately heavy to heavy wear (PM2,3); labial, lingual, and attritional surfaces brown to brownish-black stained; focal, black-stained caries; focal hypoplasia of enamel and cementum; and, slight plus to moderate tooth hypoplasia (simple reduction in size). Molar teeth: Moderate even wear (M1,2V), moderate wear, "gouged" anterior and posterior thirds (M2D); black stained, wear to or superior to gingivae (M3D); moderate plus lateral shear wear of anterior third, center or posterior third long and pointed (M3V); slight tooth hypoplasia (M3) (simple reduction in size).

5. *Severely Affected.* Incisor teeth: Enamel extensively eroded, residual enamel and/or dentin black stained (center pair usually, less frequently intermediate teeth); marked to extensive enamel hypoplasia (center focal or patchy type; intermediate patchy, more frequently shell type; lateral and corner teeth shell type); enamel uniformly olive stained and chalky stippled (intermediate, lateral, and corner teeth); marked to extensive tooth hypoplasia (center slight to moderate, progressive in successive eruptions, usually severe in inter-

mediate, lateral, and corner teeth), pronounced tooth spacing; faulty union of enamel and dentin with separation of these structures; eruption abnormally delayed and/or irregular; eruption lingual or labial to normal dental arch; and abnormal inclination. Premolar teeth: Lingual, labial and attritional surfaces brown to black stained; focal black stained caries; patchy enamel and cementum hypoplasia; heavy wear; and moderate to marked tooth hypoplasia (simple reduction in size). Molar teeth: Moderate to moderately heavy wear (M1,2V); moderately heavy wear, "gouged" anterior and posterior thirds, long, black stained spicule at posterior pole (M2D); black stained, wear superior to gingivae, gingivae and alveoli lacerated or traumatized, long, black stained spicule at either anterior or posterior pole (M3D); black stained, heavy lateral shear wear anterior third, long and pointed center or posterior third, cemental hypoplasia; extreme irregularity of attritional surfaces (M2,3) so that elongated, sharp portions of teeth (usually mandibular) penetrate the alveoli of the corresponding maxillary teeth; extreme tooth hypoplasia (usually M3) as simple reduction in size, failure of cusp formation (usually posterior third) and faulty or deficient formation of the central portions of teeth or cusps, and in extreme cases anodontia.

The deleterious effects of fluorides upon teeth are exerted principally during amelogenesis, dentinogenesis, calcification, although some fluoride is incorporated in mature teeth. It is not known if the latter is related to the development of delayed regressive enamel changes. The capacity of the placental structures to minimize the mother-to-fetus transfer of the toxic agent, the intrauterine development of the first molar and the late intrauterine and early postuterine development of the center incisor teeth, operates to limit injury to these tissues. If relatively heavy and continuous flouride ingestion commences at an early age, the center incisor teeth may suffer appreciable damage. The second molar teeth, due to the advanced intrauterine development, escape serious injury except when fluoride ingestion is initiated early in the life of the individual. The premolar, third molar and intermediate, lateral, and corner incisor teeth develop postuterine, and bear the brunt of the fluoride toxicity. These structures, during their formative stages, are exposed to the currently ingested fluorides as well as to various concentrations of the cumulative fluorides which are released in the course of skeletal metabolism. The specific effects of fluorides upon the teeth are clearly visible as the teeth erupt through the soft periodontal and alveolar tissues. Changes induced by fluorides in the labial enamel are always more severe than those in the corresponding lingual tissue.

Chalky lesions of the enamel of the teeth of human beings are classified by some authorities as an early stage of caries or decalcification. These foci appear similar to those observed in the enamel of bovine teeth. Chalky foci of the bovine enamel may progress into frank caries or persist in an arrested state for an indefinite period. These lesions may result from causes other than fluoride toxicity. Acute infectious diseases, nutritional imbalances, deficiencies, et cetera, disturb amelogenesis and calcification.

Intraenamel staining or mottling, also classified in human dental literature as carious in nature, while characteristic of fluoride interference, is not pathognomonic. Various minerals or substances other than fluorides, if present in the blood stream during tooth development, may be incorporated in the enamel and produce permanent staining. Most extraenamel pigmentation can be removed by cleaning the teeth with a mild detergent. Enamel with normally occurring vertical formative grooves or patchy hypoplasia is difficult to clean. The stains may be differentiated by the shiny, glistening appearance of the intraenamel staining as contrasted with the dull, flat appearance of the extraenamel pigmentation.

Carious and erosive lesions of the bovine enamel appear to involve the underlying dentin only to the extent of brown to brownish-black staining. Progression of this dentinal involvement has not been grossly detectable after three or four years, even though destructive enamel lesions were active. The teeth of cattle which were exposed to fluoride ingestion continuously at relatively toxic levels, commencing early in the life of the individual, usually manifest forms of enamel hypoplasia rather than stained erosive lesions.

The mildest to the most severe dental manifestations of fluoride toxicity appear to occur in the following order: (1) Chalky foci and/or opaqueness of the enamel; (2) intraenamel staining or mottling; (3) carious foci and erosive enamel lesions; (4) enamel hypoplasia (focal, patchy, shell types); and (5) tooth hypoplasia. Deciduous teeth, due to their intrauterine formation, probably are not affected by fluorides. The ingestion of increasingly toxic levels of fluorides at an early age produces distinctive and more severe dental changes in earlier dentitions.

Toxic quantities of fluorides seriously im-

pair the wearing qualities of teeth. Normal teeth chip on contact with hard objects while teeth injured by fluorides crumble. The wear of incisor teeth is greater than that of the cheek teeth of cattle continuously on pasture. The reverse is true in animals maintained in dry lot and provided with provender. Secondary dentinal reaction probably is initiated earlier in fluorotic than in nonfluorotic teeth. Closure of the pulp cavity by secondary dentinal reaction appears to be more effective in fluorotic teeth, possibly due to a decrease in sibe of the pulp cavity. Tooth hypoplasia may be confused with heavy or excessive wear. The stubby, misshapen appearance of the hypoplastic tooth and the narrow labiolingual width of the appositional surface characterize hypoplastic teeth. Irregularity of the attritional surfaces of the cheek teeth, especially of the second and third molars, may be pronounced and seriously impede masticatory function. The maxillary teeth, which usually erupt later than their mandibular counterparts, are necessarily exposed to fluorides for longer periods and usually wear at a more rapid rate. Long, pointed portions, particularly of the third molar (mandibular) painfully injure the opposing gingival and alveolar tissues. Traumatic or infectious alveolar periostitis may develop. Marked irregularities of the attritional surfaces may interfere with closure of the mouth. Prognathism may be observed in cattle exposed to higher levels of fluorides. Dependent upon the stage of development of teeth, the quantity of fluoride ingested and the length of the exposure period, teeth may be irregularly affected. Variation in affectation may be observed in different parts of the same tooth, in pairs of teeth and in different pairs of teeth of the same animal. Since one of a pair of teeth may erupt as much as six months before or later than its mate and therby be exposed for a lesser or greater period and to different concentrations of fluorides, asymmetrical involvement occurs.

An attempt to indicate the specific or relative degree of wear appears superfluous. The estimation of wear is conditioned by individual interpretation, the biological variations among animals, the age of animals, the normal individual animal variation in tooth size, nutritional and environmental influences, et cetera.

The condition of the animal and the extent of tooth injury may not necessarily be correlated. An animal exposed to fluorides during periods in which some or most of the teeth were developing would evidence dental pathology in direct proportion to the "dosage". A calf with deciduous teeth or an adult animal with permanent teeth, if exposed to acute, sublethal amounts of fluorine, would manifest systemic poisoning but no dental pathology. Fluorides in sufficient quantities to produce subacute or chronic toxicity would induce loss of condition to emaciation and skeletal changes but absence of dental lesions in an adult animal.

This classification is not intended to be, nor advanced as, a final criterion for the evaluation of dental fluorosis but rather as a guide by which, through appropriate additions, deletions, or other changes and constructive criticism, a more suitable one may be developed.

Acknowledgment

The suggestions and criticisms of Dr. L. P. Doyle, Department of Veterinary Science, Purdue University, are gratefully acknowledged.

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Swine Brucellosis Vaccination

The use of an attenuated *Brucella abortus* and simultaneous injection of a glucidic lipid suis antigen reduced by half the number of swine that were successfully infected by ocular, vaginal, and preputial routes. Of the vaccinated animals, 13 sows and three boars, a total of five revealed infection, either through bacteriological tests or by abortions. Of seven control animals, all sows, four were infected. A third group, not subjected to artificial inoculation with the disease, displayed no damage due to vaccination and a fourth group, employed to test whether the attenuated strain would be transmitted either by the genital route or by being penned together, established that it was not.—*Report Second Pan-American Congress of Veterinary Medicine.*

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Advise Farmers About Leptospirosis

The *Farm Journal* for October 1954, advises farmers to ask their veterinarians to have blood tests made for leptospirosis when collecting samples for Brucella agglutination tests; also, to insist that semen for artificial insemination comes from leptospirosis-free bulls.

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When vitamin K is administered orally, bile has a marked effect on its absorption. In the absence of bile, relatively large doses of vitamin K were ineffective for increasing the prothrombin content of blood.

Some Observations On The Longevity Of Lyophilized Biological Material

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LYOPHILIZATION (rapid dehydration under high vacuum of bacteriological material in the frozen state) is now being used widely in various laboratories for the preservation of such material.

The process has been applied to a variety of biological materials with excellent results by a number of investigators. Elser, Thomas, and Steffan[1] reported that antisera, antigens and related products showed no deterioration or loss of potency after many years storage and that bacteria and yeasts were preserved unchanged by the lyophile process for long periods.

Swift[2] reported that bacteria, when properly lyophilized, maintain their cultural, immunological, and biochemical characteristics, and their virulence for many years at room temperature. Bushnell[3] reported that, "all of the Eubacteria tested (35 genera, 500 species) were viable six months following lyophilization and that yeasts and yeast-like organisms also survived." Raper and Alexander[4] demonstrated that the lyophile process can be used successfully for preservation of certain strains of fungi. Following lyophilization, Aspergilli and Penicillia remained viable for 40 months, and Hyphomycetes for approximately 20 months. Hoffstadt and Tripi[5] have shown that viruses of vaccina, herpes simplex, Rous sarcoma, and laryngotracheitis of fowls survived for approximately three years following lyophilization. Munce and Reichel[6] reported that hog cholera virus of blood origin was still infective for at least 1,125 days following such treatment. Barratt and Tatum[7] reported that the lyophile process has been used satisfactorily for a number of years for maintaining many strains of microoganisms in the laboratories of Stanford University in California. Masucci[8] reported that the lyophile technic can be used successfully for the preservation of certain biological products, and is especially adaptable to unprocessed (whole) sera.

In previous studies investigators in the Bureau of Animal Industry have found that, following lyophilization, the pathogenicity of *Salmonella choleraesuis* can be maintained for at least ten years,[9] the pathogenicity of *Pasteurella bubaliseptica* for at least nine years,[10] and the virulence of equine infectious anemia virus for at least 32 months[11].

The object of this paper is to record the results of further studies carried out to determine the longevity of different types of lyophilized biological material by investigators in the Animal Disease and Parasite Research Branch.

Material and Methods

The various cultures of aerobic bacteria tested represented a one-to-three-day growth of the organisms from plain, serum, or glycerine agar slants suspended in sterile skim milk prior to lyophilization, while the anaerobic bacteria tested represented an 18-hour growth of the organism in thioglycolate broth.

The Newcastle disease virus tested was the allantoamnoitic fluids from a 22nd chicken embryo passage suspended in 50% sterile, skim milk.

The different strains of equine infectious anemia virus tested consisted of filtered blood serum from acute cases of the disease.

The hog cholera virus tested consisted of defibrinated blood from a hog affected with acute cholera.

The regular equipment employed by this laboratory for high vacuum desiccation of biologic material in the frozen state is known as the Flosdorf-Mudd lyophile apparatus with some modifications. The procedure consists of attaching long-necked glass ampules, containing suspensions of rapidly frozen biological material, to the apparatus for rapid dehydration under high vacuum.

Under these conditions, the frozen moisture contained in the biologic material undergoes sublimation, leaving the material in the ampules in dried, porous, and readily soluble state. All the vapor removed from the ma-

*Animal Disease and Parasite Research Branch, Agricultural Research Service.

terial is condensed and converted to a frozen mass (distillate) in a condenser immersed in a refrigerant consisting of a dry ice-alcohol mixture. This serves to maintain the vacuum and prevent passage of moisture into the vacuum pump. After 18 to 24 hours of operation, all but about 2% of the moisture has been removed from the suspension of biologic material in the ampules, which are then flame-sealed under vacuum, and stored for future use.

With the exception of the lyophilized hog cholera virus which was held at a temperature of approximately —70 C. all the samples of

TABLE 1. Tests for longevity on Group A (Lyophilized Cultures of Pasteurella bubaliseptica) (Buffalo B. Strain)

Culture Number	Date Lyophilized	Date Tested	Years Held* following Lyophilization	Test for Viability	Test for Virulence: Animal	Test for Virulence: cc. of Culture**	Exposure Method	Results killed in hours
M 718	6-28-39	10-26-49	10 1/3	+++	Horse 1411	10		18
"	"	12-13-49	10 1/2	+++	Horse 1442	10		36
"	"	5- 9-50	10 11/12	+++	Horse 1402	10		22
"	"	"	10 11/12	+++	Calf 3278	6		22
"	"	5- 8-51	11 5/6	+++	Horse 1426	5		30
"	"	8-28-51	12 1/6	+++	Horse 1470	10		60
M 1027	"	12-13-49	10 1/2	+++	Horse 1109	7		36
"	"	5- 5-53	13 11/12	+++	Horse 1415	8		18
M 1305	7- 1-42	12-13-49	7 5/12	+++	Horse 1420	10		48
"	"	5- 8-51	8 5/6	+++	Horse 1122	10		40
1387	2-16-45	10-26-49	4 2/3	+++	Horse 1366	10		24
"	"	12-13-49	4 5/6	+++	Horse 1438	10		23
1433	11-23-48	12-13-49	1 1/12	+++	Horse 1452	10		36
"	"	5- 9-50	1 1/2	+++	Horse 1404	10		20
1402	5-11-50	8-28-51	1 1/4	+++	Horse 1467	10		40
"	"	5- 5-53	2 11/12	+++	Horse 1510	8		36
							INTRAMUSCULAR	

*Approximate time in years after lyophilization.
**Nutrient broth cultures incubated 24 hours or longer used for exposure.

TABLE 2. Tests for longevity on Group B (Various types of lyophilized cultures of microorganisms)

Indentity of culture	Date Lyophilized	Date Tested	Time held after Lyophilization (years)	Test for Viability	Test for Virulence
B. anthracis-Avirulent-97	9-13-49	5-12-53	3 2/3	+	0
" " " P-S-1	"	"	3 2/3	+	0
" " " SA-34	"	"	3 2/3	+	0
C. pseudodiphtheriticum ATCC 10700	7-19-51	"	1 5/6	+	0
C. pyogenes—ATCC 10138	"	"	1 5/6	+	0
L. monocytogenes 4518	9-15-49	"	3 2/3	+	0
Sal. Darby—6153-90	5- 3-49	"	4	+	0
Sal. choleraesuis—SR 6725	6-14-45	"	7 11/12	+	0
Shig. equirulis DM-1	9-13-49	"	3 2/3	+	0
A. necrophorus—SR 7278	10-19-45	"	7 7/12	+	0
Cl. chauvoei—7340	11-14-45	5-27-53	7 1/2	+	Pathogenic for guinea pigs
" " —6242	6-15-45	"	7 11/12	+	"
" " —2585	11-13-45	"	7 1/2	+	"
Cl. septicum—44703	7-18-47	"	5 5/6	+	"
Cl. perfringens— Type D SR 10583	7-18-47	"	5 5/6	+	0
" " " 4510 A	2-12-48	"	5 5/12	+	0
" " " 4612 B	11-13-52	"	6/12	+	0

biological material tested were stored at temperatures ranging from 5 to 10 C.

The vials of lyophilized biological material selected for testing were handled as follows: The vials were first tested for vacuum. Each vial was then opened aseptically and the desiccated material was reconstituted by the addition of sterile distilled water, nutrient broth, or physiological saline. The samples of lyophilized bacteria, after being reconstituted, were tested for viability by transfer to suitable culture media and incubation at 37 C. for at least 24 hours while tests for pathogenicity were carried out by animal inoculation tests on appropriate species of animals. Virulence tests on the lyophilized viruses were carried out by the inoculation of susceptible animals, or in the case of Newcastle disease virus, by inoculation of chicken embryos.

Protocols of Studies

The results of the longevity tests on the viability of the lyophilized biological material are recorded as groups A, B, C, and D. Tests on the material cited in first three groups were carried out by the author, while the material listed under group D was tested by different members of the Animal Disease and Parasite Research Branch as indicated in the tabulated data.

Group A consisted of cultures of *Past. bubaliseptica* which represented isolations made from the blood of horses killed by passage of the virulent Buffalo B strain; see table 1.

Group B consisted of aerobic and anaerobic cultures of bacteria from the Animal Disease and Parasite Research Branch's stock culture collection; see table 2.

Group C consisted of different strains of equine infectious anemia virus isolated from horses affected with the acute type of the disease; see table 3.

Group D included several cultures of microorganisms, a strain of hog cholera virus and a strain of Newcastle disease virus, each of which was tested by members of the Animal Disease and Parasitic Research Branch as indicated; see table 4.

Additional information on the biological material tested will be found in the tabulated data, in tables 1, 2, 3, and 4.

Summary

The results of these experiments indicate that lyophilization is a convenient and highly effective method for preservation of many types of bacteria and viruses.

Lyophilized nonpathogenic cultures, vacuum sealed and stored at 5 to 10 C., were found to be viable from one year and six months to 11 years and ten months following lyophilization.

Lyophilized pathogenic cultures maintained under identical conditions were found to be both viable and pathogenic for periods from six years and three months to 13 years and 11 months.

Different strains of equine infectious anemia virus were still virulent from two years and eight months to six years and ten months subsequent to lyophilization.

Hog cholera virus of blood origin was still fully virulent six years and two months after lyophilization when held at —70 C.

Newcastle disease virus was still virulent three years and 10 months after lyophilization but showed a 100-fold decrease in embryo minimum lethal dose.

TABLE 3. Tests for longevity on Group C (Lyophilized samples of Equine Infectious Anemia virus*)

Virus	Identification Strain	Date Lyophilized	Date Tested	Time held after lyophilization (years)**	Test for virulence*** Test Horse	Date Reacted	Incub. Period (days)	Type of Disease
1295	Wyoming	5- 2-45	3-20-52	6 5/6	1483	5-10-52	51	Acute
1379	"	5-29-45	9-24-48	3 1/3	1394	10-17-48	23	Subacute
1379	"	"	3-20-52	6 3/4	1484	4- 1-52	12	Acute
1401	New Hampshire	9-24-47	3-20-52	4 1/2	1504	4- 2-52	13	Acute
1401	" "	"	10- 1-53	6 7/12	1531	10-17-53	16	Subacute
1406	Kentucky	4-15-48	3-20-52	3 11/12	1482	4- 1-52	12	Acute
1042	Wyoming	2- 4-49	7-16-53	4 5/12	1511	7-27-53	11	Subacute
1042	"	"	10- 1-53	4 7/12	1529	10-14-53	13	Acute
1420	New York	5-21-49	3-20-52	2 5/6	1487	4-13-52	23	Subacute
1477	Nebraska	11-29-50	3-20-52	1 1/3	1503	4- 9-52	20	Acute

*—Filtered virulent blood serum stored at 5° to 10° C.
**—Approximate time in years.
***—10 cc. of reconstituted virulent serum injected subcutaneously.

Acknowledgments

The writer is indebted to the following members of the Animal Disease and Parasite Research Branch for their cooperation in furnishing data covering the longevity tests on the biological material reported under group D for inclusion in this report: Mr. Thomas E. Amerault, Dr. Edwin R. Goode, Dr. W. J. Hall, Dr. L. O. Mott, Dr. R. D. Shuman, Dr. C. H. Thompson, Dr. J. P. Torrey, and Dr. J. E. Williams.

Acknowledgement is made also of the valuable technical assistance rendered by Dr. D. W. Gates and Mr. Herbert Rogers in handling some of the biological material tested.

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TABLE 4. Test for longevity on Group D (Various types of lyophilized biological material)

Identity of lyophilized material tested	Date Lyophilized	Date Tested	Yrs. held after Lyophilization	Test for Viability	Test for Virulence	Tested by
Br. abortus S-2016	10-27-41	5-13-53	11 1/2	+++	None	Mr. T. E. Amerault Dr. E. R. Goode
" *suis* S-1705	6-25-41	"	11 5/6	+++	"	"
L. monocytogenes S-223	5-12-42	"	11	+++	"	"
Sal. rostock-E. strain	10- 8-43	5-12-53	9 7/12	+++	"	Dr. J. E. Williams
" *cerro*-E. strain	10- 8-43	"	9 7/12	+++	"	"
" *pullorum*-W. strain	1- 1-50	"	3 1/3	+++	"	"
Sal. gallinarum—S-1272T From outbreak pullorum dis.	2- 1-47	5-21-53	6 1/4	+++	Pathogenic for 4 birds	Dr. W. J. Hall
Sal. allinarum—S-1272T From outbreak fowl typhoid	10- 1-45	"	7 1/2	+++	Pathogenic for 5 birds	"
Past. multocida—Fowl strain From outbreak fowl cholera	2- 1-47	"	6 1/4	+++	Pathogenic for 3 birds	"
Ery. rhusiopathiae A Strain—M3LP3	5- 4-48	5-13-53	5	+++	Pathogenic for mice and pigeons	Dr. R. D. Shuman
Ery. rhusiopathiae Strain C	2-28-46	"	7 1/4	+++	"	"
Dess. *Ery. rhusiopathiae* vaccine (commercial)	6-22-48	5-12-53	4 11/12	+++	"	"
Newcastle disease virus Calif. strain 11914	7-26-49 (titer 10^{9}/cc.)	5- 6-53 (titer 10^{7}/cc.)	3 10/12	11-day old chicken embryos	Lethal for 11-day-old ch. embryos	Dr. C. H. Thompson
Hog cholera virus 7183-0 (blood origin) From acute case hog cholera collected 10-15-46 and held frozeen until lyophilized 3-20-47	3-20-47	5-13-53	6 1/6	None	Lethal for 2 pigs in 1:10,000 dilution	Dr. L. O. Mott Dr. J. P. Torrey

Will Your Practice Get Its Share of Tax Relief?†

The sweeping new tax code is estimated to have cut $1,363,000,000. from business and personal taxes this fiscal year. Perhaps twice that sum will be saved in future years.

Many of the provisions are already in effect. The operating decisions you are making day by day may determine whether or not you can get the most benefit from the new provisions.

You should consult you tax adviser at once if you have not already done so. The gimmicks are many. The "ifs", "ands", and "buts" pop up all over the place. It will take an expert to guide you through the fine print. Though, in general, the new tax law is much more liberal toward business than the old one, some loopholes have been plugged and some provisions bear down a little harder.

Seven Main Areas

Seven main areas can be spot-lighted. But remember, every business has its own conditions to consider. No general statement should be applied without full study and consultation with an expert.

Faster Depreciation

Depreciation write-off is greatly speeded. A much greater portion of the cost of new (not used) equipment can be written off in the early part of the useful life of the asset. Under one new method, for example, double the amount previously allowed can be written off in the first year. Obviously this is big news to a business that wants to modernize or expand.

The deductions are no greater over the entire useful life, but they are much greater in those years when the expenditure is most felt and before returns may begin to taper off because of obsolescence. Ask your tax adviser how the various new methods can help you—the "declining balance" method . . . the "sum-of-the-years' digits" method . . . Don't let the lingo throw you!

Ask him whether a "switch" from one method to another might be advantageous. Be sure to note that some switches are permissive automatically and some are not, and that the kind of records you keep (or fail to keep) may defeat the benefit the law holds out to you.

Immediate Deductions for Research and Development

Research and development costs now may be deducted in the year they are incurred. You no longer have to wait to get a patent or give up your experiment as a failure before deducting your costs.

More Realistic Tax Accounting

Tax accounting under the new law has been brought more nearly into line with generally accepted accounting principles. Income reporting can be more realistic. You can deduct from current receipts estimates of such future expenses as refunds and rebates, allowances for discounts, claims for damages, et cetera. You can report advance rentals in the years in which they will be earned and in which you will have expenses such as maintainance or repairs to deduct.

The estimated expenses can be deducted if you can make a reasonably accurate estimate based on your own experience or that of others in similar circumstances. Of course only those anticipated expenses which apply to the revenue of the current period may be deducted.

Altogether there will be less difference between taxable income and net income as it is figured by accountants for ordinary business purposes.

You May Elect Lower Corporate Taxes

Partnerships and proprietorships now may, under certain circumstances, elect to report and be taxed as corporations. Some businesses will want to take advantage of the lower corporate rates at certain levels, remembering, however, that once elected the practice must be continued unless there is a 20% or more change in ownership. And remembering, too, that though owners may escape an immediate high personal tax bracket by electing to report as corporations, assets kept in the business may later be subject to estate tax or income tax (as dividends or capital gains). Take care to look into all aspects with your certified public accountant before you change.

Aid in Accumulating Earnings for Expansion

Retention of earnings for future expansion or modernization is made easier by the granting of a $60,000. accumulation-credit (total for all years). Also, if any part of a greater accumulation is deemed not for "reasonable needs" of the business, the penalty tax is applied only to that particular part, not to the entire accumulation for the year, as formerly.

†This article is based on material supplied by the American Institute of Accountants, New York 16, N. Y., national professional society of certified public accountants.

Most important of all, burden of proof is now laid upon the Internal Revenue Service, not on you. In most cases, a business with legitimate savings for bonafide purposes of expansion or modernization need no longer fear the penalty tax.

Greater Offsets to Losses

Under the old tax law, if you suffered a net loss one year, the impact might have been softened somewhat by a carry-back to the preceding tax year. This carry-back generally meant you received a refund of some or all of the taxes you had paid the year before. Any losses not absorbed in this way would be carried forward for as many as five years following your loss year. These carry-forwards would reduce your taxes in later years, but they were no help in bringing in immediate cash. Now the new law provides for a carry-back for two years instead of one, in addition to the five-year carry forward. In many instances, this will mean that greater refunds of prior taxes will be available to add to your working capital.

These are only the highlights. Over 3,000 technical changes have been made in this colossal overhauling of the federal tax code. You may have to lose some sleep before you understand all the provisions that are important to your particular business. But once you do, chances are you'll be happier with the new law than you were with the old.

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Brucellosis Eradication Campaign in Denmark

Examination of statistical data available indicates that Denmark may be Brucella-free by 1961. In his discussion at the XV International Veterinary Congress, Stockholm, Sweden in August 1953, P. A. Bruhn stated that the number of registered, brucellosis-free herds has risen from 7.7% in April 1946 to 77.5% in January 1952. The estimate of the date that Brucella infection may be eradicated in Denmark is on the assumption that the present campaign, making use of the ABR (milk ring test) and blood agglutination test, is maintained on its present high level.

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Field trials with an experimental antiprotozoan drug designated PAA-701 is reported to have definite, direct action on *Anaplasma marginale* infection in cattle.—*Vet. Rec.*, Sept. 4, 1954.

Check Source of Psittacine Birds

Psittacosis or parrot fever, the viral disease of parrots, parakeets, other psittacine birds, and possibly some domesticated fowl is transmissible to man, usually causing symptoms of pulmonary disorder and pyrexia. Since there are practically no interstate regulations governing transportation of psittacine birds, and since the demand for the shell parakeet, or budgies, has increased it is to be expected that the disease in humans may be observed quite frequently.

It has been alleged that some unscrupulous breeders have kept visibly ill parakeets alive by administering antibiotics. It also has been alleged that some birds have been imported illegally from tropical countries. If there is a parakeet in a home where members of the family have virus pneumonia or flu, it might be advisable to suggest to the attending physician that laboratory or epidemiologic studies be conducted on the parakeet. An educational program has been suggested to acquaint the public with the hidden danger of acquiring psittacine birds from other than reputable dealers. Since pigeons, ducks, turkeys and chickens also may be reservoirs of infection for man, the incidence of frequently occurring pulmonary conditions and fever in a family should be checked carefully.

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Vibriosis in Idaho

Cost of vibriosis to Idaho sheepmen in abortions and weak lambs is estimated at $1,000,000. annually. Ewes survive the disease and appear to be immune, bearing sound lambs the second year and thereafter.

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Workers in Texas report (*Jour. Nut.*, 51:507, 1953) evidence confirming earlier findings that antibiotics stimulate growth by reducing the total number of clostridia in the intestinal tract of chicks, and are ineffective growth stimulators when chicks are raised in a clean environment.

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In a comparison of the merits of soilage versus rotational grazing, which experiment was conducted at the Minnesota station, no difference in milk production was apparent. There was, however, considerable advantage in favor of soilage feeding rated by milk yields per acre of crop. The method has practical value for large herds.

The Use Of Beta Irradiation In Veterinary Ophthalmology

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BETA-RAY applicators for the treatment of superficial conditions of the eye have been found to be beneficial, and applicators using radon, radium or radioactive phosphorous have been used for many years[1]. More recently, other applicators which have definite advantages have been developed. Among these are applicators using Sr^{90} and Ru^{106}. The most popular of these is Sr^{90}, a radioactive isotope which is a pure beta ray emitter.

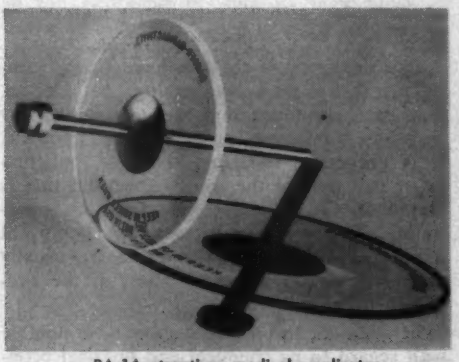
Before considering the construction and clinical applications, it is well to consider some of the radiobiologic characteristics of such radioactive isotopes.

General Radiology

The types of penetrating radiations with which we are chiefly concerned in biology and medicine are *x*-rays, gamma rays, fast and slow neutrons, and beta and alpha particles.

Radioisotopes may decay by emission of alpha, beta, or gamma radiations. A particular radioactive atom is either an alpha emitter or a beta emitter. It cannot emit both kinds of particles simultaneously. A single atom can emit both an alpha and a gamma radiation or a beta and a gamma radiation. Gamma radiation is nonparticulate. Alpha and beta rays are particulate. The alpha particle carries a positive and the beta particle a negative charge. Radioactive decay has given rise to the term of *half-life* which is the time required for a radioactive substance to lose, by decay, 50% of its activity.

It should be noted that ionizing radiations are produced by fluoroscopes, radioactive machines, and some radio transmitters, as well as by radioactive substances. Radiations from machines can be as potent as radiations from radioisotopes.



RA-1A strontium medical applicator

All types of radiation produce a biological effect of an identical type varying only in a quantitative manner. Although the alpha particle has approximately 10,000 times the ionizing strength of the gamma ray, it must be taken into the body in order to produce its effect, inasmuch as its penetrating power is such that it cannot traverse the thickness of the skin. On the other hand, the gamma ray has tremendous penetrating power so that

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all portions of the body are easily accessible to it. The alpha and beta particles become important only if these fission products are taken into the body and deposited there. The beta particle has a maximum penetrating power in tissues of less than 1 cm. and the amount of ionization which it produces lies between that of the alpha particle and the gamma ray.

The energy delivered by beta radiation is measured in roentgens equivalent beta—the amount of radiation which produces in a tissue phantom the same amount of ionization produced by one roentgen of gamma rays in air.

Characteristics of Beta Irradiation

Rapid absorption in tissues limits the penetration of beta particles to a few millimeters of the surface structures, therefore avoiding damage to deeper tissues. Most beta rays are absorbed in the first 3 mm. of tissue.

The short range of beta particles in tissue is particularly useful in radiation therapy. This is true in the eye where it is important to protect deeper structures, such as the lens from the deleterious effects of radiation.

The chief effect of beta radiation in the eye is the inhibition of proliferation of capillary endothelium in newly forming vessels.

Since the rays can be controlled to be effective only upon the most superficial layers of tissue, they afford a surprisingly high degree of safety in their application.

It is necessary in the treatment of eye conditions that a pure beta emitter be selected, that is, a substance that has no gamma ray emission, to assure protection of the lens. It is necessary, too, that the beta radiation be of that part of the energy spectrum that is therapeutically effective yet not too penetrating. This is true particularly in therapy at the cornea, or limbus, since the lens is usually about 4.5 mm. from the surface of the eyeball in this area.

In addition, the element should be suitable with regard to its chemical and physical properties so that ease of manipulation, high chemical purity, high specific activity, is possible.

The use of Sr^{90} in an applicator meets these requirements. It is a pure beta emitter having a half life of 25 years. Its radioactive decay produces yttrium-90 with which it is in equilibrium, and which, in turn, gives off moderately strong beta particles of which 97% is absorbed in a tissue depth dose of 4 mm. The use of yttrium-90 as a primary source of beta radiation is impractical inasmuch as Y^{90} has a half life of 62 hours. By the use of Sr^{90} as a source of Y^{90}, the half life problem of Y^{90} is overcome. Y^{90} decays to form stable zirconium and the radioactivity ceases at that level. The beta radiation of strontium-90 is absorbed in tissues as follows[3]:

55%—absorbed at 1 mm. depth
80%—absorbed at 2 mm. depth
94%—absorbed at 3 mm. depth
97%—absorbed at 4 mm. depth

A typical case of pigmentary keratitis in the dog.

Description of the Sr^{90} Applicator*

This applicator uses a 50 mc. source of strontium-90, which has a half life of about 25 years, and which gives a dosage rate of between 40 and 50 roentgens-beta-equivalent per second at the surface of the applicator. The exact surface dosage is stamped on each unit.

The source itself is protected by a double hermetic seal, and it is covered by 2 mils of stainless steel and 10 mils of aluminum, which results in a total covering of about 100 mg./cm^2. The radiation emitted by the source consists of the 0.537 MEV beta rays through which strontium-90 decays to yttrium-90 and the 2.18 MEV beta rays through which yttrium decays to stable zirconium. Thus, essentially only beta particles are given off by the applicator.

The source has an active diameter of 7.8 mm. and an overall diameter of 12.7 mm. It is mounted on the end of a 6¾ in. shaft. A 4 in. diameter by ¼ in. circular plastic shield also is mounted, and may be moved to any desired position along the shaft. It will stop virtually all of the radiation emitted by the source.

*RA-1A Strontium Medical Applicator—Traceriab, Boston, Massachusetts.

Beta radiation emitted from these applicators is ideal for the treatment of certain eye conditions because the rays from a Sr^{90} will not penetrate to the lens, whereas *x*-ray or gamma radiation in relatively small dosage will produce cataracts in a high percentage of instances.

Clinical Applications

The strontium-90 beta ray applicator has received considerable use in human and veterinary medicine.

Friedell[3] describes the following conditions where this type of therapy appears favorable:

1. *Superficial Tumors.* Small, benign tumors and shallow growths that cannot be excised especially papillomas of the lids and conjunctiva. Usually one or two treatments of 325 rep each are sufficient.

2. *Pterygia.* 325 rep at weekly intervals to a total of four treatments. The devascularization of pterygia is a controlling influence to these growths, and their progress is arrested.

3. *Vascularization of the Cornea.* Used to prevent and to obliterate corneal vascularization. It inhibits the proliferation of capillary endothelium in newly forming vessels—infiltrating loops being stopped short by beta radiation. Larger and well established vessels

Sr^{90} applicator in use. Photograph taken by Leon Schwartz, Department of Radiation Biology, University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.

also can be obliterated by larger doses of beta radiation directed to the limbus—the radiation inducing an obliterative vasculitis and final occlusion. The radiation has been administered in courses, usually totaling 1,300 rep, in a period of one month (325 rep x 4). The radiation, except in selected cases, must be applied to the limbal regions only. Any treatment to the central region of the cornea must be done only with great caution and at infrequent intervals, since perforation of the cornea may be produced readily by excessive radiation.

(a) *Trachomatous pannus.*
(b) *Prevention of revascularization* of the corneal stroma after superficial keratectomy.
(c) *Prior to corneal transplant* for prevention of vascular invasion.
(d) For prevention of vascular invasion following corneal transplant.
(e) Chemical burns of the cornea.

4. *Corneal Ulcers.* Beta radiation applied to the limbal region directly adjacent to the ulceration.

The diseases of the canine eye which have been treated successfully with beta radiation include[4]: Chronic ulcerative keratitis, chronic interstitial keratitis, and flat corneal neoplasms-pterygiums.

The canine cornea has been found to tolerate single doses of 35,000 rep. From 15,000 to 30,000 rep are currently employed at weekly or biweekly intervals until the desired corneal improvement is achieved. These doses are considerably higher than those used in human medicine.

The greatest use of the strontium-90 beta ray applicator in veterinary medicine has been in the treatment of keratitis pigmentosa of the dog[4,5]. In this condition, the cornea becomes invaded by vessels from an intensely vascularized conjunctiva, and later as a brownish pigmentation is deposited in the cornea, the dog eventually becomes blind. Corneal pigmentation appears most commonly in breeds with large eyes such as Boxers, Boston Terriers, and Pekingese and is also seen in other breeds[6]. The condition is usually bilateral.

The pigment has been identified as melanin[6]. Pigmentation of the superficial cornea originates in the germinal epithelium and, to a limited extent, from the limbus. Pigmentation of the deep corneal stroma, in the absence of superficial pigmentation, originates in the uveal tract.

Three cases of pigmentary keratitis in the cat have been reported by Roberts[6].

The strontium-90 beta ray applicator has also been used in superficial ocular neoplasms of horses and cows[7].

It should be noted that the use of beta irradiation for the treatment of corneal ulceration due to pyogenic infection is contraindicated because of the possibility of aggravating the condition.

Technic of Application

The dog can tolerate a single dose of 27,000 rep applied over a discoid area of 1 cm. when treated with Sr^{90}. In the treated area, an increased degree of vascular injection for three or four days is found occasionally after treatment, however, this soon recedes[5].

Chandlin[5] states that 50,000 rep can be applied over one eye at one time in overall distribution to five areas (5 sq. cm.) of the cornea without damage to the normal tissues. The greatest intensity given to any one point (1 sq. cm.) in the dog's eye was 27,000 rep in one dose.

When the applicator is used on the dog, the animal usually is given a general anesthetic. Pontocaine 0.5% is instilled into the eye to abolish corneal reflexes. To control movement of the eyeball, two cotton sutures are placed in the sclera at the limbus. The applicator is held lightly against the cornea for the required length of time. Chandlin[5] has used the applicator up to 18 minutes at a time with a total emission of 27,000 rep with improvement noted after one application or upon repetition at one to two-month intervals. Friedell[8] uses up to 1,800 rep per treatment at weekly intervals in man up to a total average dose of 12,000 rep in some lesions.

The applicator is placed in contact with the corneal lesion along the limbus to affect the vessel near its origin. Whenever possible, the center of the cornea is avoided. While using the applicator it occasionally is necessary to moisten the eyeball with saline to prevent dehydration. Occasionally, after treatment, there may be evidence of irritation which may be treated by the instillation of a mild ointment.

Summary

There are several reports in literature on the use of beta irradiation of the canine eye in the treatment of various lesions including pigmentary keratitis, chronic and interstitial keratitis, and flat corneal neoplasms. The most desirable source of this form of irradiation appears to be strontium-90.

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▼ ▼ ▼

Wing Fracture Treatment in Birds

We have been requested to outline a simple technic for treating wing fracture in birds. Canaries seem to be prone to this traumatism as a result of getting a wing caught in the wires of the cage during excited fluttering. In general, the wing bones correspond closely to those of mammals. The humerus is pneumatic and therefore comparatively fragile. The outstanding symptom is a drooped wing and inability to raise it. Most operators are in agreement that, in a small bird such as the canary, the bird's own body is the best splint. Usually the fracture is a simple one, not compound. By careful manipulation, the broken segments are brought in apposition and the wing raised, along with the other wing, so that the feature tips of the two wings cross, to a moderate degree, over the region of the lumbar-sacral union, and maintained in that position by a piece of adhesive tape transversely placed. To keep the wings in this position, a somewhat broader piece of tape is passed around the entire body over the fractured area so as to immobilize both wings to the body. To secure additional rigidity and to aid in maintaining the adhesive tape in position, a third comparatively narrow strip is placed over the region of the back extending backward from the anterior edge of the broad tape around the wings and body to the posterior edge of the tape holding the tips of the wings. All tapes may be removed in three weeks as union of the fractured ends will have taken place.—*R. R. Dykstra, D.V.M.*

▼ ▼ ▼

Dog owners are hearing a great deal about infectious hepatitis in their pets and many are concerned that the canine disease is transmissible to man. There have been no reports of human cases of epidemic hepatitis directly contracted from dogs, nor does there appear to be any relationship between these diseases.

Present Knowledge Of The Systemic Mycoses In Dogs: A Review†

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WITH more cases being reported each year from all species, it becomes increasingly apparent that the systemic mycoses in animals are not the rare diseases they were once thought to be. Even though the isolation and identification of the parasitic fungus is the only means for positive diagnosis of active infections, an indication of the widespread existence of some of these diseases has been demonstrated by serological surveys in various parts of the nation. With the increased awareness of the importance of systemic mycoses in domestic animals, more and more veterinary laboratories are providing facilities for mycological diagnosis; and as case reports presenting the symptomatic picture of these diseases in dogs accumulate in the literature it is increasingly possible to make a tentative diagnosis clinically.

In general the systemic mycoses should be suspected in all cases of chronic disease which fail to respond to ordinary therapy. This paper attempts to tabulate and evaluate the symptoms and lesions of the more important canine systemic mycoses, and to suggest diagnostic procedures which may aid in clinical recognition.

Histoplasmosis

The etiologic agent is the fungus imperfectus *Histoplasma capsulatum* Darling. It occurs as the yeast-like form in tissues and exudates and on blood agar at 37 C., and as the mycelial form on the routine mycologic media at room temperature.

The disease in dogs is primarily a chronic, debilitating, digestive disturbance with enlarged abdomen, hepatomegaly, and ascites as prominent symptoms. Chronic cough and dyspnea are frequently present. (Fig. 1)

Diagnosis

1. *Symptoms and Lesions.* See table 2 for a summary of the published case reports[10,11,12,14,15,17,18,19,20,21,24,25,26,28,29,30,31].

2. *Radiography.* Seldom of value unless pulmonary lesions are present.

3. *Microscopic Examination.* Peripheral blood, sputum, bone marrow biopsies, and scrapings from the edges of accessible ulcers are examined as Giemsa or Wright stained smears (see table 1).

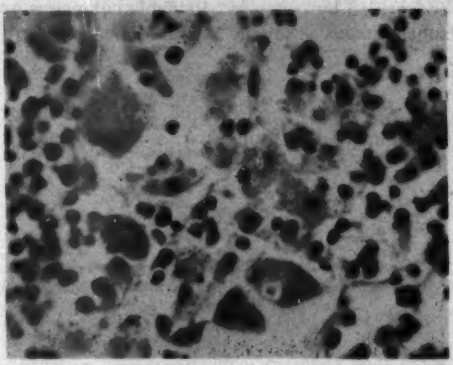

Fig. 1. Histoplasmosis. Tissue from a lymph node showing reticuloendothelial cells containing Histoplasma capsulatum††

4. *Mycologic Examination.* Inoculate suspected material on blood agar (incubate at 37 C.) and on Sabouraud or Littman oxgall agar (incubate at room temperature). Cultures should be retained at least 30 days before discarding as negative.

5. *Histologic Examination.* The lesions are usually chronic inflammatory granulomata without necrosis or suppuration, containing single or budding organisms, usually within macrophages or giant cells. Sections may be stained by Bauer's method[6].

6. *Serologic Examination.* The histoplasmin skin test [13,16,22] has been used widely in serological surveys of domestic animals and man.

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In dogs 0.1 cc. of a standardized filtrate of a broth culture of *H. capsulatum* (histoplasmin) is injected intradermally in the medical surface of the flank skin fold. An area of edema 5 mm. or more in diameter after 48 hours is considered a positive reaction[15].

Complement fixation tests have been used experimentally; one technic[39] employs histoplasmin and the other[37] the yeast-like phase of the organism as the antigen.

North American Blastomycosis

The etiologic agent is the fungus imperfectus *Blastomyces dermatitidis* Gilchrist and Stokes. It occurs as the yeast-like form in tissues and exudates and on blood agar at 37 C., and as the mycelial form on the routine mycologic media at room temperature. (Fig. 2).

The disease in dogs is often a chronic debilitating pulmonary condition frequently accompanied by lameness. Palpable cutaneous or subcutaneous swellings sometimes are evident.

Diagnosis

1. *Symptoms and Lesions.* See table 3 for a summary of published case reports[28,34,35,36,37,39,42,45,48,44].

TABLE 1. Morphology of Organisms As Seen in Body Fluids, Tissues, and Exudates

Actinomyces bovis	Intertwining mycelial clumps (rosettes, sulfur granules); hyphae (clubbed ends or not) radiate from center, are approximately 1 micra in diameter. Stain Gram (+) and acid fast (—).
Nocardia asteroides	Intertwining mycelial clumps; hyphae not clubbed, are approximately 1 micron in diameter. Stain Gram (+) and acid fast (+).
*Coccidioides immitis**	Thick walled sporangia or spherules, 10-80 micra in diameter, contain endospores 2-5 micra in diameter or granular material. Also empty ruptured spherules, or immature spherules (which may resemble Blastomyces).
*Histoplasma capsulatum**	Small, round or oval, single or budding yeast-like organisms, 1-3 micra in diameter; free or within the cytoplasm of macrophages. Stain well with Wright or Giemsa (dark centers, clear halo).
*Blastomyces dermatitidis**	Round or ovoid, budding or non-budding, thick walled (wall may appear double) yeast-like organisms 7-18 micra in diameter. Hyphae not seen.
*Cryptococcus neoformans**	Round or ovoid, single or budding, thick walled, yeast-like organisms, 5-15 micra in diameter. Wide gelatinous capsule seen in India ink preparations. No mycelial development. Gram (+).

* In those organisms possessing a cellulose capsule, its demonstration by Bauer's method[6] is most useful in establishing a diagnosis histologically.

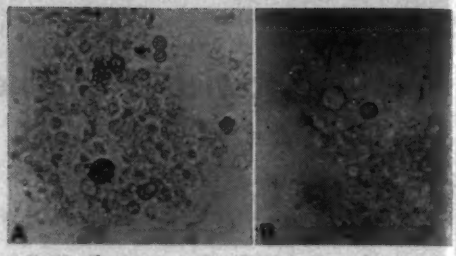

Fig. 2. Blastomycosis. (A) Single budding organisms in pus, wet preparation, unstained. (B) Single thick-walled double contoured organism in pus††

2. *Radiography.* Tubercle-like nodules in the lungs.

3. *Microscopic Examination.* Aspirate pus and examine as a wet mount for budding blastomycetes (see table 1).

4. *Mycologic Examination.* As for histoplasmosis.

5. *Histologic Examination.* Lesions are characteristically granulomatous nodules containing a small amount of pus in the center along with the causative organisms. They tend to be multiple and confluent.

6. *Serological Examination.* Complement fixation tests have been used experimentally. One technic[48] uses blastomycin as the antigen, the other[38] a saline suspension of the organism.

TABLE 2. A Tabulation of the Incidence of Symptoms and Lesions in Canine Histoplasmosis Compiled From Published Case Reports

Symptoms in 27 cases	No. of cases	% of cases	Lesions in 27 cases	No. of cases	% of cases
Cachexia	20	74%	Emaciated carcass	19	70%
Diarrhea	17	63%	Hepatomegaly	10	37%
Anorexia	12	44%	Splenomegaly	5	19%
Enlarged abdomen	10	37%	Enlarged lymph nodes	4	15%
Intermittent or continuous fever	8	29%	Bronchopneumonia	1	4%
Hepatomegaly	8	29%			
Ascites	6	22%			
Chronic cough	6	22%			
Depression	6	22%			
Progressive weakness	6	22%			
Anemia	5	19%			
Dyspnea	4	15%			
Palpable abdominal mass	3	11%			
Icterus	3	11%			
Splenomegaly	3	11%			
Enlarged lymph nodes	3	11%			
Persistant vomiting	2	7%			

Coccidioidomycosis

The etiologic agent is the fungus imperfectus *Coccidioides immitis* Rixford and Gilchrist. It occurs as empty and endospore-containing spherules in animal tissues and exudates (see table 1), and in the mycelial form on culture media. No yeast-like phase is produced. (Fig. 3 and 4.)

The disease in dogs is often a generalized granulomatous condition involving the lungs as the primary site. Partial anorexia, vomition, and distress or collapse after eating are prominent symptoms. Lameness and bone involvement are sometimes seen.

TABLE 3. A Tabulation of the Incidence of Symptoms and Lesions in Canine Blastomycosis Compiled From Published Case Reports

Symptoms in 14 cases	No. of cases	% of cases	Lesions in 20 cases	No. of cases	% of cases
Dyspnea	7	50%	Tubercle-like lesions or focal abscesses in the:		
Lameness or stiff gait	7	50%	lungs	15	75%
Cachexia or weakness	6	43%	liver	4	20%
Anorexia	5	36%	spleen	2	10%
Depression	5	36%	diaphragm	1	5%
Palpable cutaneous or subcut. swellings	5	36%	lymph nodes	1	5%
Fever	4	29%	kidneys	1	5%
Dermatitis	3	21%	intestine	1	5%
Scleritis	2	14%	Edematous or supurative lymph nodes	6	30%
Swollen joints	2	14%	Cutaneous swellings or lesions	4	20%
Purulent nasal discharge	2	14%	Subcut. abscess	2	10%
Sudden death	1	7%	Solidified lungs	2	10%
Pain	1	7%	Pleuritis or thoracic adhesions	2	10%
Restlessness	1	7%	Abdominal mass	1	5%
Pur. ocular disch.	1	7%	Peritonitis	1	5%
Convulsions	1	7%	Bone lesions	1	5%
Blindness	1	7%	Purulent joints	1	5%
Dehydration	1	7%	Emaciation	1	5%
Keratitis	1	7%			
Gangrenous breath	1	7%			

Diagnosis

1. *Symptoms and Lesions.* See table 4 for a summary of published case reports[40,47,48,49,50,51,52].

2. *Radiography.* Pulmonary nodules with metastasis to other organs.

3. *Microscopic Examination.* Material aspirated from lesions should be examined as wet mounts for typical spherules (see table 1).

4. *Mycologic Examination.* Inoculate suspected material on Sabouraud or Littman oxgall agar and incubate at room temperature.

5. *Histologic Examination.* Lesions are suppurative or granulomatous, and contain single endospores and spherules, usually within macrophages and giant cells. Sections may be stained by Bauer's method[9].

6. *Serologic Examination.* A coccidioidin skin test is sometimes used[52].

Fig. 3. Coccidioidomycosis. Sporangium filled with endospores in pus††

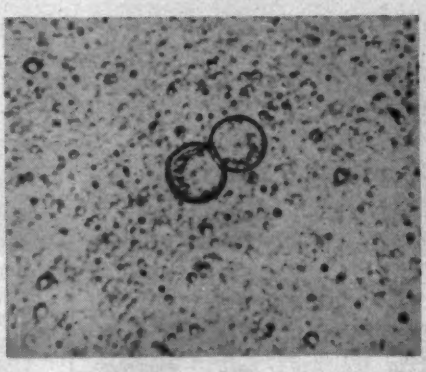

Fig. 4. Coccidioidomycosis. Two attached endospores. Resemble B. dermatitidis††

Actinomycosis

The etiologic agent is the anaerobic actinomycete *Actinomyces bovis* Harz. It occurs only in the mycelial form, appearing, usually, in lesions and exudates as mycelial clumps or rosettes (sulfur granules). (Fig. 5.)

The disease in dogs is often a chronic pleuritis or peritonitis with intermittent or continuous fever and leukocytosis and/or neutrophilia.

Diagnosis

1. *Symptoms and Lesions.* See table 5 for a summary of published case reports [63,64,65,66,67,69].

2. *Radiography.* Pleuritis or hydrothorax may be evident.

3. *Microscopic Examination.* Exudates or material aspirated from abscesses should be spread thinly in a sterile petri plate and examined in strong light for yellow to tan mycelial rosettes. These may be transferred to a slide, crushed beneath a cover slip and stained by Gram's and the acid fast methods (see table 1).

4. *Mycologic Examination.* Inoculate suspected material into shake cultures, thioglycollate broth, or other anaerobic media and incubate at 37 C.

5. *Histologic Examination.* The lesions are infectious granulomata containing intertwining hyphae (club-bearing rosettes or sulfur granules) which stain blue centrally and red on the periphery with hematoxylin and eosin. These may be differentiated from the rosettes of actinobacillosis by the Gram stain.

Few case reports of the following mycoses have appeared in the veterinary literature up to the present time.

TABLE 4. A Tabulation of the Incidence of Symptoms and Lesions in Canine Coccidioidomycosis Compiled From Published Case Reports

Symptoms in 5 cases	No. of cases	% of cases	Lesions in 4 cases	No. of cases	% of cases
Emaciation	4	80%	Miliary nodules in lungs	4	100%
Partial anorexia	2	40%	Rough nodular growths in:		
Vomition	2	40%	spleen	2	50%
Distress or collapse after eating	2	40%	liver	1	25%
Lameness	2	40%	kidneys	1	25%
Dyspnea	1	20%	pleura	1	25%
Cough	1	20%	diaphragm	1	25%
Dehydration	1	20%	Pale thoracic fluid	1	25%
Shivering	1	20%	Thoracic adhesions	1	25%
Diarrhea	1	20%	Purulent pericardium	1	25%
Superficial lymph node enlargement	1	20%	Splenomegaly	1	25%
Tense abdomen	1	20%	Hepatomegaly	1	25%
Listless	1	20%	Bone-like enlargement on mandible	1	25%
Circling	1	20%	Brain lesion	1	25%
Cloudy cornea	1	20%			
Painful jaws	1	20%			

Fig. 5. Actinomycosis. "Sulfur granule" with clubbed hyphae in pus††

Nocardiosis

The veterinary literature on nocardiosis is somewhat confused because, until recently, this disease was not differentiated adequately from actinomycosis. The etiologic agent is the aerobic actinomycete *Nocardia asteroides* (Eppinger) Blanchard. It occurs only in the mycelial form, and in exudates and lesions appears most generally as mycelial clumps. (Fig. 6).

A case reported by Bohl, *et al*[71] presented the following symptomatology: Body pain, subcutaneous swelling, depression, bloody diarrhea, hyperemic mucous membranes, encrusted nostrils, salivation, slight fever, chorea, and nystagmus. *X*-ray examination revealed multiple pulmonary nodules. In a case diag-

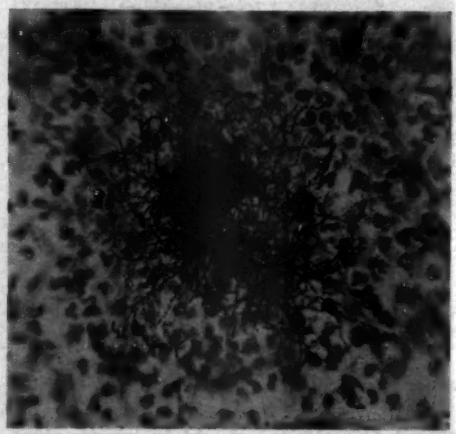

Fig. 6. Nocardiosis. Clump of organisms in pus. Gram stain††

nosed mycologically by Neal[74] the incomplete clinical picture was anorexia, listlessness, and multiple subcutaneous abscesses. The postmortem appearance of both dogs was strikingly similar; both carcasses were emaciated; there were extensive suppurative lesions of the subcutis; and raised, gray, soft, nonencapsulated nodules in the lungs, myocardium, spleen, kidneys, and lymph nodes. The former case also revealed nodules on the diaphragm, and the latter in the musculature of one leg, the liver, pleura, and pericardium.

A recent report by Cross, *et al.*[73] describes two additional cases. One was diagnosed clinically, and on postmortem, as distemper, the other as "hard-pad syndrome". Both had enlarged, abscessed, granulomatous, bronchial lymph nodes from which *N. asteroides* was isolated. The lungs, in one case, were purulent and granulomatous.

TABLE 5. A Tabulation of the Incidence of Symptoms and Lesions in Canine Actinomycosis Compiled From Published Case Reports.

Symptoms in 6 cases	No. of cases	% of cases	Lesions in 7 cases	No. of cases	% of cases
Intermittent or continuous fever	4	67%	Thickened or nodular pleura	4	57%
Leukocytosis and/or neutrophilia	4	67%	Abnormal thoracic fluid:	4	57%
Pleuritis or pneumonia	3	50%	brown-black	2	29%
Dyspnea	2	33%	bloody	1	14%
Serous or mucopurulent nasal disch.	2	33%	seropurulent	1	14%
Abdomen tense and enlarged	2	33%	Peritoneum thickened with tumorous masses	2	29%
Subcutaneous abscess	2	33%	Hepatomegaly	2	29%
Bronchitis	1	17%	Thoracic cavity black, scattered white granular material	1	14%
Icterus	1	17%			
Diarrhea	1	17%			
Bloody feces	1	17%			
Congested MM	1	17%	Lungs consolidated, black and rough	1	14%
Emesis	1	17%			
Cachexia	1	17%	Lungs atelectatic	1	14%
Weakness	1	17%	Cardiac hypertrophy	1	14%
Depression	1	17%	Ascites	1	14%
			Serosal hemorrh.	1	14%
			Liver abscesses	1	14%
			Mass on stomach wall	1	14%
			Splenic hemorrh.	1	14%
			Emaciation	1	14%

Diagnosis

2. *Symptoms and Lesions.* See preceding.

2. *Radiography.* Metastatic nodules may be evident.

3. *Microscopic Examination.* As for actinomycosis (see table 1).

4. *Micologic Examination.* Inoculate suspected material on Sabouraud or blood agar and incubate aerobically at 37 C.

5. *Histologic Examination.* As in actinomycosis. Hyphae are not clubbed.

Cryptococcosis

The etiologic agent is the fungus imperfectus *Cryptococcus neoformans* (Sanfelice) Vuillemin. It occurs only in the yeast-like form on culture media and in the animal body. (Fig. 7 and 8).

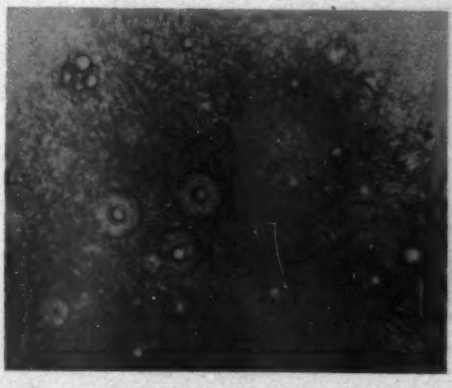

Fig. 7. Cryptococcosis. Organisms in pus unstained. Note broad capsule††

Seibold, *et al.*[74] have reported the only case of canine cryptococcosis noted in the literature*. Symptoms were anorexia and incoordination with the head held to one side. The clinical diagnosis was otitis media. On postmortem, there was a purulent sinusitis, congestion of the lungs and spleen, and granulomatous lesions of the meninges and ventricular walls. These latter contained the organism.

Holzworth and Coffin[75] and Holzworth[76] have reported two cases in cats, both showing chronic respiratory symptoms.

*Recently Riser[75a] reported two cases of similar pathology and symptoms which were presented by E. L. Jungherr and E. L. Stubbs, at the Third Seminar (1952) of the American College of Veterinary Pathologists.

Diagnosis

1. *Symptoms and Lesions.* See preceding.

2. *Radiology.* Pulmonary or brain lesions may be evident.

3. *Microscopic Examination.* Skin scrapings, sputum, spinal fluid and material aspirated from lesions are examined as wet preparations for yeast-like organisms (see table 1). Mix a drop of India ink or Gram's iodine with a drop of detergent; add a small amount of suspected material and cover with a cover slip. A broad capsule about the organism is pathognomonic for Cryptococcus.

4. *Mycologic Examination.* Inoculate suspected material on Sabouraud or Littman oxgall agar and incubate at 37 C.

5. *Histologic Examination.* Lesions are infectious granulomata containing single or budding organisms. Gram's stain is more satisfactory than hematoxylin and eosin for demonstration of the organism.

Fig. 8. Cryptococcosis. Organisms in spinal fluid. India ink preparation††

Mucormycosis

The etiologic agent is a phycomycete of the genus Mucor. The organisms appear in infected material as branching nonseptate hyphae with small, oval sporangiophores 2-3 micra in diameter. (Fig. 9).

Gleiser[77] reports two cases of canine mucormycosis and cites a third[78]. In the reported cases, both animals had convulsions, one was emaciated with subnormal temperature, the other exhibited bloody diarrhea, anorexia, serous ocular discharge, unsteadiness in the hind legs, emesis, and dilatation of the pupils. On postmortem, both revealed diffuse granulomatous lesions of the cerebral and cerebellar cortices. In addition, the former had an enlarged granulomatous and necrotic kidney and a granulomatous stomach ulcer; the latter congested lungs, with areas of consolidation.

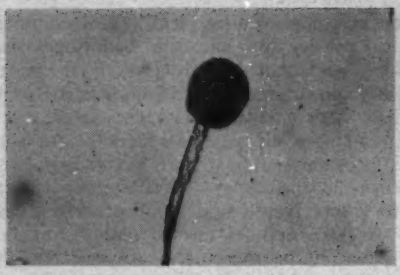

Fig. 9. Mucor sp. Non-septate hypha and terminal spherical sporangium††

Preparation of Material for Laboratory Diagnosis

Symptoms and lesions, radiographic examination, microscopic examination of accessible materials are all aids to arriving at a tentative diagnosis, and this often may be all that is necessary. The positive diagnosis of mycotic diseases, however, depends upon isolation and identification of the etiologic agent. This usually requires equipment and experience beyond that of the average practitioner.

Should confirmation be desired, it would be necessary to enlist the services of a veterinary diagnostic laboratory. Material to be sent may be of two types: (1) Tissue preserved in 10% formalin for histologic examination, in which case only a tentative diagnosis may be made, or (2) unpreserved tissues, exudates, scrapings, or body fluids for mycologic examination. Handling of the latter requires some special precautions.

If the material for mycologic diagnosis is to be taken to the laboratory personally, it may be collected in a sterile container, being particularly careful to avoid further contamination.

If the material must be mailed it should be inoculated aseptically upon slants of a suitable culture medium. Sabouraud agar is most commonly used for this purpose. Sometimes several tubes may be secured from the laboratory and kept on hand in the refrigerator, or a small stock may be prepared easily from the dehydrated medium. Specimens for mailing that are not prepared in this way usually become so quickly overgrown with saprophytic organisms that it is impossible to isolate the pathogen.

Whatever is sent to the laboratory should be accompanied by a complete case history that includes the diagnostic procedures employed, and the disease suspected or tentatively di-

agnosed. This latter is particularly important because, for example, cultures received are routinely incubated aerobically by most laboratories, which would be wholly unsatisfactory for the cultivation of *Actinomyces bovis*.

Discussion

The systemic mycoses in dogs are all subacute or chronic debilitating diseases. They all may manifest themselves superficially as well as systemically and cutaneous lesions should not be overlooked. The present stage of therapeusis is largely experimental; chemotherapeutic and biotherapeutic agents now in use are seldom effective where the disease has progressed beyond the stage of practical surgical intervention.

The parasitic fungi which cause these diseases are relatively non-host specific and similar conditions are seen in most domestic animals and man. For that reason the widespread occurence of some of these diseases in dogs is of actual or potential public health importance.

The diagnositic procedures suggested should enable the clinician, in many instances, to differentiate these diseases from others which they may resemble symptomatically. Some of the conditions in dogs with which the systemic mycoses may be confused are:

1. Swellings or nodules: Benign or metastatic tumors, tuberculosis, single or metastatic abscesses, toxoplasmosis, actinobacillosis, et cetera.

2. Chronic diarrhea: Acute infectious diseases, coccidiosis, toxoplasmosis, helminthiasis, poisoning, et cetera.

3. Emaciation: Chronic disease, helminthiasis, malnutrition, et cetera.

4. Encephalitis: Postdistemper, postrabies vaccination, "old dog", otitis media, rabies, poisoning, et cetera.

5. Dermatitis: Superficial mycoses, acariasis, allergy, hormonal, et cetera.

Summary

The clinical syndromes most often seen in published cases of the systemic mycoses in dogs are:

Histoplasmosis. Chronic, debilitating digestive disturbance with enlarged abdomen, hepatomegaly, and ascites as prominent symptoms. Chronic cough and dyspnea are frequent.

North American Blastomycosis. Chronic, debilitating pulmonary condition often accompanied by some degree of lameness. Palpable cutaneous or subcutaneous swellings are frequent.

Coccidioidomycosis. Generalized granulomatous condition involving the lungs as primary site. Partial anorexia, vomition, and distress or collapse after eating are frequent. There may be lameness and bone involvement.

Actinomyosis. Chronic pleuritis or peritonitis with intermittent or continuous fever and leukocytosis and/or neutrophilia.

Nocardiosis. Generalized granulomatous condition.

Cryptococcosis. Encephalitis or chronic respiratory condition.

Mucormycosis. Cerebral or cerebellar involvement.

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(Continued on page 490)

Toxoplasmosis

There has been an increasing interest among epidemiologists and veterinarians on the prevalence and distribution of toxoplasmosis. This interest has centered mainly around the potential sources of Toxoplasma infection, inasmuch it is not known how it is transmitted to man except by congenital means — mother to fetus. The disease occurs in many species of animals and birds, including dogs, rabbits, moles, pigeons, mice, rats, squirrels, monkeys, guinea pigs, canaries, sheep, swine, and cats.

The disease is described as a protozoan infection which may be acquired prenatally from the mother or at any time of life postnatally. It is primarily a disease of children and rare in adults. Prenatal infection acquired in gestation may lead to the death of the fetus or to manifestations at birth consisting of chorioretinitis, cerebral calcification, hydrocephalus or microcephalus, psychomotor retardation, or convulsions. Prenatal infection acquired late in gestation may be manifested after birth by fever, jaundice, hepatomegaly, splenomegaly, xanthrochromic spinal fluid, and convulsions. Infections acquired after birth may be mild, with no recognized symptoms, or may be manifested by fever, lymphadenopathy and lymphocytosis lasting a few weeks, or may be severe with a generalized exanthema, jaundice, and cerebral manifestations often leading rapidly to death.

A definite diagnosis either in man or animals is through the demonstration of the etiologic agent in body tissues or fluids taken by biopsy or at autopsy. The isolation of the organism is by inoculation of laboratory-reared toxoplasma-free albino mice, hamsters, rabbits, or guinea pigs, with tissue emulsion, blood, or spinal fluid of patients. A serological diagnosis can be made by demonstrating a rise in the titer of specific antibodies by complement fixation. The Sabin-Feldman methylene blue dye test is also of value.

As stated above, the source of infection for man or animals is not known. The only known human source is the pregnant woman in the primary stage of the infection who infects the fetus *in utero* or during delivery. Animals can be infected by feeding infected tissues. It is thought that animals may spread infection during the acute stage or as long as organisms are excreted in feces, urine, or saliva. Recently Cole, Prior, Docton, Chamberlain, and Saslaw reported on a study of families exposed to Toxoplasma-infected pet dogs. Twelve of the 28 Toxoplasma-infected pet dogs were examined at the Ohio State University Hospital. Of the 37 people who were examined in this group, 35 stated that they were in good health. Physical examination of these 35 persons gave no evidence of active toxoplasmosis. Ten of these persons were sensitive to toxoplasmin and nine had Toxoplasma antibodies in their blood sera. Titers greater than 1:16 were interpreted as indicative of current or past Toxoplasma infection by the authors. One patient whose serum contained Toxoplasma antibodies at titers of 1:80 rose to 1:160 a month later. Swiss mice inoculated with blood from this patient developed toxoplasmosis. The dog that belonged to this patient had been ill for four weeks prior to admission to the veterinary clinic. While at home it had been fondled like a child and carefully nursed during its illness. The animal had Toxoplasma antibody titer of 1:80 and reacted to toxoplasmin. On autopsy organisms were demonstrated histologically in the lung, tonsil, bronchial node, and heart. Toxoplasma organisms were isolated by inoculation of mice with tissue emulsion. The presence of organisms in the tonsil and lung suggests that sputum and saliva might have contained organisms during the course of the illness.

In the patients in this series, one of the two persons who was ill was a woman who was admitted to the University Hospital with encephalitis of six weeks duration. She reacted to toxoplasmin and her serum contained Toxoplasma antibodies in a titer of 1:256 as measured by the dye test. The complement fixation test was also strongly positive, suggesting recent infection. A clinical diagnosis of toxoplasmosis, encephalitis, and neuroretinitis was made. This woman resided on a farm where she had contact with chickens, cattle, horses, dogs, and cats. A dog from this farm was found to be sensitive to toxoplasma and its serum contained antibodies. Histological examination of organs at autopsy revealed Toxoplasma in lesions of the mesenteric lymph node, stomach, liver, and heart. The authors state that excretion of Toxoplasma in the feces or vomitis was possible since organisms were seen in the walls of gastric ulcers.

The other ill patient of the two in the group of 37 was a three-year-old boy. The diagnosis on this child was chorioretinitis and encephalitis. The boy's serum revealed a high antibody titer; his mother also had a titer. The mother was asymptomatic and gave no history suggesting toxoplasma infection. The father was negative to all tests. Nine dogs owned

by the family were subsequently studied for evidence of toxoplasmosis. The sera from two dogs gave positive titers and causative organisms were demonstrated in various organs of both these dogs. The distribution of Toxoplasma in the organs suggested potential dissemination in the sputum and feces.

In another family group where there was no evidence of illness a high titer was found in the serum of the mother and a lower titer in her three-year-old son. Their pet dog was revealed to be infected by serological examination and Toxoplasma organisms were isolated by mouse inoculation from organs collected at autopsy. Still another family in which there were no symptoms was found to be sensitive to toxoplasmin and their sera contained antibodies. Their pet dog had a titer of 1:320 and organisms were demonstrated in the lungs, intestine, bronchial node, spleen, and pancreas. A second dog in this household died of toxoplasmosis. One of the members of this family had cared for these pets in addition to 44 Chihuahuas, of which 14 pups and 15 adults died of toxoplasmosis. Sera from three other families which were exposed to infected dogs contained no detectable antibodies.

The authors' conclusions are that this study suggests some relationship between animal and human toxoplasmosis. The following relationship may be more than coincidental to them: (1) Toxoplasma parasitemia was demonstrated in a 26-year-old woman who cared for her Toxoplasma-infected pet dog during four weeks of its illness, (2) a pet dog owned by a 28-year-old woman with toxoplasmic neuroretinitis and encephalitis had active toxoplasmosis, (3) two of nine dogs which were pets of a three-year-old boy with toxoplasma chorioretinitis and encephalitis had toxoplasmosis.—*James H. Steele, D.V.M.*

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Myxomatosis

Notice appears in a recent issue of *The Veterinary Record* that myxomatosis in rabbits has been confirmed on the Royal estate at Sandringham, England and has spread across Norfolk, involving more than 60 parishes. This disease was introduced purposely in rabbits in Australia to reduce their numbers in that country.

The Response of Kittens to Three Strains of Newcastle Disease Virus

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Young rabbits were found to be susceptible, by intracerebral inoculation, to all six egg-adapted Newcastle disease virus (NDV) strains by Reagan *et al*[1]. NDV was also successfully passed by Reagan *et al*[2] through 330 Syrian hamster brain passages, but with the exception of the hamster, the NDV has not been grown for more than a few generations in hosts other than fowl[3].

Materials and Methods

The egg-adapted NDV strains: California, Colorado, and Kentucky, used for this study were obtained in 1946 from the Bureau of Animal Industry, Department of Agriculture, Washington, D. C. These strains were isolated by the Animal Industry Bureau from infected chicken tissue in the corresponding states before the introduction of commercial live virus vaccine for Newcastle disease. The cultures had been carried through six serial egg passages and were then carried 12 additional passages in ten-day embryonating chicken eggs at this laboratory. Embryo passage of the California strain was continued through the 29th passage. Allantoamniotic fluid from several dead eggs of each strain was harvested, pooled separately for each, and stored at -60 C. in the deep freeze. All three strains of the virus were confined to be NDV by neutralization tests conducted in ten-day embryonating chicken eggs. The tests were performed according to the procedure recommended by the Bureau of Animal Industry[4]. Newcastle-immune chicken serum neutralized the virus in all cases while normal chicken serum had no effect. The three NDV strains were removed from the deep freeze and thawed in a 45 C. water bath.

Five-tenths ml. of infected allantoamniotic fluid from the thawed embryonated egg passage material of all strains was inoculated, intracerebrally, into each of three young kittens. Upon evidence of Newcastle disease symptoms the kittens were sacrificed, their brains were aseptically removed, the three brains of each

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group were pooled, ground with alundum and made into a 10% suspension with physiological saline. Three groups of 12 each ten-day embryonated chicken eggs were inoculated in the allantoic cavity with each NDV strain, and within 72 hours most of the embryos were dead. The allantoamniotic fluid was collected from the dead eggs for each strain of virus. A neutralization test was conducted on each of the three pools of allantoamniotic fluid and verified the infectious agents to be NDV. Six normal kittens, of the same age, were held for 14 days as controls and remained in good health throughout.

Results

Within 48-72 hours the three groups of inoculated kittens all evidenced typical Newcastle disease symptoms: Irritability, malaise, conjunctivitis, partial loss of muscle control, rigidity, pulsations of the tail, and a muscular jerking similar to that encountered in infected chickens. It was evident that the illness was more progressive and severe in the California-strain-inoculated group, and that the Colorado strain was less virulent than the other two strains.

Embryonated eggs inoculated with brain suspensions from the three groups died within 72 hours. Neutralization tests conducted on the infected allantoamniotic fluid from the eggs verified the agents to be NDV.

Summary

Young kittens two weeks of age were found to be susceptible to the California, Colorado, and Kentucky strains of Newcastle disease virus (NDV) by intracerebral inoculation. The California strain created much more severe symptoms and the Colorado was least virulent. Neutralization tests conducted on allantoamniotic fluid from eggs inoculated with kitten brain suspensions verified the agents to be Newcastle disease virus. A group of control kittens were held for 14 days and remained in good health throughout.

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Midwest Small Animal Association Announces Meeting Plans

Dr. Frank R. Booth, Elkhart, Indiana, president of the Midwest Small Animal Association has invited all veterinarians interested in small animals to attend the 18th annual meeting of this group. This meeting also functions as a regional meeting of the American Animal Hospital Association. Sessions will be held in the Burlington Hotel, Burlington, Iowa, November 10-11, 1954, A full, two-day program will feature guest speakers from five states of the Midwest.

The traditional Catfish Dinner will provide the feast the evening of the first day, which, as customary, will be followed by discussions of interest to practitioners of the region.

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Yet Rabies is Tolerated

Mass vaccination of dogs, elimination of strays or unwanted dogs, and control of wild life (by ruthless extermination if need be) have been the means at hand for almost 70 years of eliminating rabies. Yet the disease is allowed to perpetuate itself in dogs as well as in wildlife because of the activities of misinformed and misguided individuals who hold themselves as champions of dumb animals. Vaccination has been shown to be harmless and many examples exist to illustrate efficacy of these prophylactic measures. One wonders why the intelligent society of which we boast has neglected to accept the facts resulting from practical field experience in mass vaccination and failed to make manditory its practice for the mutual benefit of man and animals.

In recommending the three-step program for rabies control Dr. Hilary Koprowski and Dr. Robert L. Burkhart cited recent experience in Malaya where vaccination became compulsory on January 1, 1953. No case of rabies in man or animals has been reported from that Asiatic state since June 1953. In the State of Israel, incidence of the disease has been reduced significantly during the past five years.

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Pseudorabies (Aujesky's disease—infectious bulbar paralysis—mad itch) in dogs, as it has been observed in Texas, probably results from feeding on a bovine carcass dead of the disease. The disease is characterized by intense itching. Death occurs in three to four days after appearance of symptoms.—*W. W. Armistead, D.V.M.*

(References continued from page 486)

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Trichophyton granulosum was the infective agent isolated as the cause of "fur slipping" in chinchilla. This report, appearing in the *Canadian Journal Comparative Medicine* for October, 1953, states that lesions appeared first on the nose and around the anus. Denuded areas of skin were scaly but not inflamed. Pruritus was evident. Lesions appeared in other parts of the body in some animals, in others they were limited to the nose and anus. The fungus infection responded to application of quaternary ammonium compounds.

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Not infrequently there is observed, at autopsy of dogs, small thrombi attached to the endocardium of the left atrium. These are attributed to leptospirosis infection.—*Loren D. Kintner, D.V.M.*

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The use of police-trained dogs in Hyde Park, London has eliminated handbag snatchers and other criminal prowlers.—*Dog Oddities.*

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If you pay a man to tell you what to do, you'd better do what he tells you. —*Philip Armour.*

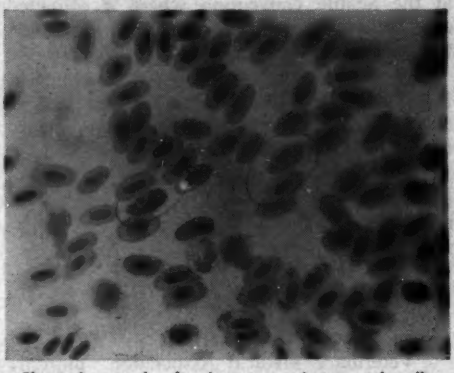
This appealing photograph of a little miss playing in shallow water under the watchful eye of her Boxer companion won second prize and $250. for May Mirin, of New York City, in the 1953 dog photo contest of the Gaines Research Center.

Haemoproteus Columbae Infection in Florida Pigeons†

CHARLES F. SIMPSON,* B.S., D.V.M.; E. W. SWARTHOUT,** D.V.M., Gainesville, Florida

Experiments designed to determine the susceptibility of small field rodents and birds to a hematozoan infection, *Anaplasma marginale*, of cattle have been in progress at the Florida Agricultural Experiment Station for several years. One phase of this work involved the inoculation of anaplasmosis blood into the common pigeon, *Columbia livia*. The birds in this study were trapped at random in a park of a city in Florida. It was several days after capture that the authors procured possession of the pigeons. The trapping officials, however, did not report that the birds were infested with external parasites or were abnormal in any respect.

Ten pigeons were chosen from the group of trapped birds for inoculation purposes. Prior to injection, blood smears were made from the wing vein of each pigeon and stained with Giemsa blood stain. The parasite, *Haemoproteus columbae*, was found in the stained blood films of all ten birds. Varying degrees of parasitism existed between pigeons, large proportions of the red cells being parasitized in some birds and few in others. Hemoglobin values ranged from 16.0 to 19.4 gm. per 100 cc. of blood. Gametocytes, in various stages of growth, were evident in the infected blood. Early, ring forms were scarce, and adult, elongated, halter-shaped gametocytes were most commonly observed. The mature organisms often encircled the nucleus of the pigeon red cell to such an extent that one side and both poles were embraced by the parasite. Growth of the gametocytes generally, but not always, caused the nucleus of the red cell to be displaced to the periphery Only rarely were two mature gametocytes observed in the same red cell. No other blood parasites, such as trypanosomes, were observed in the pigeon blood. The demonstration of the parasite in ten birds by such a random sampling technic would indicate that the infection is common in at least one city in Florida. Wenyon[1] mentions that *H. columbae* is a parasite of the common pigeon, and has been reported from South Europe, Africa, India, and South America. He also notes that "it will probably be found to have a much wider distribution, and to occur in birds other than the common pigeon". Biester and Devries[2] relate that the parasite occurs throughout the tropical and subtropical world, the southern part of the United States, and sporadically in northern sections. The shipment of parasitized Florida birds to Iowa is incriminated as the origin of an outbreak of infection of pigeons in that midwestern state[3]. Bishop[4] reports that pigeons from Virginia, Maryland, and the District of Columbia have been found to harbor the organisms in their blood. Refurezo[5] says that the infection is commonly found in pigeons in the Philippines.



Photomicrograph showing two pigeon red cells parasitized with Haemoproteus columbae

The asexual cycle of *H. columbae* takes place in the pigeon, and the sexual cycle of the infection occurs in the pigeon fly, *Pseudolynchia maura*, a blood-sucking insect. The existence of the fly in Florida, most of the southern states, Arkansas, Kansas, Iowa, and California has been documented by Bishopp[4].

The disease in pigeons caused by *Haemoproteus columbae* is commonly called pigeon malaria. Mortality rarely occurs in birds as a result of the infection, although Coatney[6] noted the association between morbidity and a heavy infestation in one bird. The ten birds referred to in this paper did not exhibit signs of abnormality as a consequence of the infection.

Summary

Ten pigeons trapped at random in a Florida city park were found to be parasitized with *Haemoproteus columbae*, the organism of pigeon malaria. No outward evidence of morbidity was observed in these birds. The demonstration of the parasite by such a sampling technic would indicate that the infection

(Continued on page 494)

†Florida Agricultural Experiment Station, Journal Series, No. 271.
*Associate Veterinarian.
**Associate Poultry Pathologist (Dade City).

EDITORIAL COMMENTS

World Veterinary Periodicals

During the course of a survey to determine the numbers, objectives, and type of material included in the world's periodic veterinary literature, the editors of VETERINARY MEDICINE prepared a display of sample copies of those available. This display of 95 magazines, published at regular intervals, was the feature exhibit in the booth assigned us at the Seattle convention where it attracted considerable attention and interest. (See illustration below).

Not all are included in these following listings and collection of samples from various countries is continuing. Information in regard to omissions will be welcomed.

Listed below are those which were included on the display rack with their frequency of issue.

ENGLISH LANGUAGE

United States

1. Journal of the American Veterinary Medical Association — monthly
2. Veterinary Medicine — monthly
3. North American Veterinarian — monthly
4. American Journal of Veterinary Research — quarterly — quarterly

University Publications

5. Cornell Veterinarian — quarterly
6. University of Pennsylvania Bulletin — quarterly
7. Veterinary Science News (Wisconsin) — quarterly (irregular)
8. O.V.C. Bulletin — quarterly

State Association Publications

9. California Veterinarian, The — bimonthly
10. Florida Veterinary Bulletin — not stated
11. Georgia Veterinarian, The — bimonthly
12. Illinois Veterinary Bulletin — bimonthly
13. Iowa Veterinarian — bimonthly
14. Kansas Veterinary Medical Association Bulletin — bimonthly
15. Maine Veterinarian, The — quarterly
16. Michigan Veterinarian, The — quarterly
17. Missouri Veterinary Medical Association Bulletin — irregular
18. Oklahoma Veterinarian, The — quarterly
19. Rocky Mountain Veterinarian — monthly
20. Texas Veterinary Bulletin — monthly
21. Veterinary News — bimonthly
22. Virginia Veterinarian, The — quarterly
23. Washington State Veterinary Medical Association—Quarterly Bulletin — quarterly

Supply House Organs

24. Allied Veterinarian — bimonthly
25. Bio-Chemic Review — bimonthly
26. Corn States Needle, The — bimonthly
27. Goshen Practitioner, The — not stated
28. Haver-Glover Messenger — bimonthly
29. Jen-Sal Journal — bimonthly
30. Norden News — bimonthly
31. Therapy Bulletin (Jen-Sal) — bimonthly
32. Upjohn Scope — bimonthly
33. Veterinary Bulletin (Lederle) — quarterly
34. Veterinary Excerpts — bimonthly

Student Publications

35. Auburn Veterinarian, The — quarterly
36. I.S.C. Veterinarian — triannually
37. M.S.C. Veterinarian — triannually
38. Oklahoma Veterinary Bulletin — quarterly
39. Southeastern Veterinarian, The — quarterly
40. Southwestern Veterinarian. The — quarterly
41. Speculum, The — quarterly
42. Veterinary Scope — quarterly

Other Organizations

43. American Animal Hospital Bulletin — bimonthly
44. A.V.M.A. Women's Auxiliary News — quarterly
45. Federal Veterinarian, The — bimonthly
46. K.C.V.C. Alumni Quarterly — quarterly

English Language Elsewhere

Australia

47. Australian Veterinary Journal — monthly

Canada

48. Canadian Journal of Comparative Medicine and Veterinary Science — monthly

Ceylon

49. Ceylon Journal of Veterinary Science — monthly
50. Ceylon Veterinary Journal — quarterly

Great Britain

51. Veterinary Record, The — weekly
52. Veterinary Bulletin, The — monthly
53. British Veterinary Journal, The — monthly
54. Journal of the Royal Army Veterinary Corps, The — quarterly

India

55. Indian Veterinary Journal — bimonthly

Philippine Islands

56. Philippine Journal of Animal Industry — quarterly

South Africa

57. Journal of South African Veterinary Medical Association — quarterly
58. Onderstepoort Journal of Veterinary Research — quarterly
59. The Pennant — not stated

Other than English Language

Argentina

60. Revista de Medicina Veterinaria — triannually
61. Revista de Veterinaria Militar — bimonthly
62. Giencia Y Ganaderia — monthly
63. Agronomia Veterinaria — monthly

Brazil

64. Revista Ceres — bimonthly
65. O Veterinario — quarterly

Colombia, S. A.

66. Revista de la Facultad Medicine Veterinaria Y de Zootechnia — not stated

France

67. Veterinaires — monthly
68. Recueil de Medecine Veterinaire — monthly
69. Bulletin de L'Academie Veterinaire — monthly
70. Revista de Faculdade de Medicinia Veterinaria — not stated
71. Office International Des Epizooties — not stated
72. Bourgelat — quarterly

Germany

73. Berliner und Münchener Tierärztliche Wochenschrift — monthly
74. Der Lebensmitteltierarzt — monthly
75. Der Pragtische Tierarzt — monthly
76. Deutsche Tierärztliche Wochenschrift — monthly
77. Monatschefte fur praktische Tierheilkunde — monthly
78. Tierärztliche Umschau — monthly
79. Veterinar Medizinsche Nachrichten — monthly
80. Zeitschrift für experimentelle Veterinarmedizin — monthly

Indonesia

81. Hemera Zoa — not stated

Italy

82. La Clinica Veterinaria — monthly
83. Gazzetta Veterinaria — not stated
84. Zootechnica e Veterinaria — monthly
85. Zooprofilassi — monthly

Japan

86. Japanese Veterinary Medicine — not stated
87. Bulletin of the Faculty of Agriculture, Jamaguti U. — not stated

Jugoslavia

88. Veterinaria — not stated

Mexico

89. Medicina Y Cirugia Zootecnica: monthly (bimonthly)

Portugal

90. Revista de Ciencias Veterinaries — biannual

Russia

91. Betephhapnr — monthly

Spain

92. Baletin. de Dioulgacion Ganadera — triannually

Switzerland

93. Schmeizer Archiv fur Tierheilkunde — monthly

Uruguay, S. A.

94. Veterinaria Uruguay — not stated

Yugoslavia

95. Veterinarski Arhiv — bimonthly

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The Federal Debt

At the end of 1953, the total federal debt was $275 billion. Over the preceding seven years it had declined by $1.7 billion. At this rate of reduction we should have no debt by the year 2884. Even multiplying the present debt reduction rate by ten would not alter the fact that no reader of today is likely to see a time when the absolute size of the federal debt is small.

Though there is little hope for a small national debt, there is prospect for a less burdensome one, or smaller in relation to the national income.

A policy statement prepared by the Committee for Economic Development (CED) points out that, since the end of World War II, the ratio of debt to income has declined from 127% to 74%. Almost all of this has resulted from the increases in the national income. Only about half of the increase in income has resulted from price rises, the balance as the result of real economic growth.

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Erratum

It was stated editorially in VETERINARY MEDICINE for September 1954, page 365, that blue-tongue vaccine was available for the control of this virus disease in sheep and goats. We have been advised, by competent authority, that extensive research indicates that goats are not susceptible to blue-tongue, nor are they carriers of the causative agent.

Armed Forces Veterinary Officers to Attend Special Atomic Radiation Course

Veterinary Corps officers of the Army and the Air Force will receive special training in evaluating the effects of ionizing radiation from atomic weapons on foods and food-producing animals.

The two-week course is the first of its type to be offered in the United States. The classes will be conducted at the Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee. The Institute is a non-profit, educational corporation of 32 southern universities.

The curriculum includes biological aspects of radiation phenomena, dosimetry, radiobioassay in animal tissues, radiation syndromata in the domestic animals, and disposition and salvage of radio-contaminated foods. This will be presented by lectures, applicatory exercises, training films, and demonstrations.

Veterinary officers have been responsible for determining the wholesomeness and quality of foods for troops since World War 1. This course in radiological health is specifically designed to prepare them for their responsibilities in atomic defense.

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Improvement in technic of collecting, freezing, and storing semen and inseminating cows has increased the average number of cows bred by a single sire from 228 in 1939 to 1,848 in 1953.

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Blood Parasites of Pigeons

(Continued from page 491)

is common in pigeons in at least one city in Florida.

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2. Biester, H. E., and Devries, Louis, Diseases of Poultry. Ames, Iowa State College Press, 1943, pp. 787-788.

3. Drake, C. J., and Jones, R. M., The Pigeon Fly and Pigeon Malaria in Iowa. *Iowa Jour. Sci.*, 4:253, 1930.

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6. Coattney, G. R., Relapse and Associated Phenomena in the Haemoproteus Infection of the Pigeon. *Am. Jour. Hyg.*, 18:133, 1933.

MORE SEATTLE CONVENTION NOTES

Education Exhibits

A five-man committee of judges selected the exhibit of the Washington State Student Chapter of the A.V.M.A., Important Features of Leptospirosis in the Bovine, and Fluorosis in Domestic Animals, and that prepared by the USDA, Bovine Tuberculosis and Its Control in the United States, as tied for first place awards.

All educational exhibits again this year represented much thoughtful planning and work and had useful educational value.

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Minneapolis in 1955

The dates of Aug. 15-18, 1955 have been set for the 1955 annual meeting of the A.V.M.A. The Radisson Hotel in Minneapolis will be principal headquarters, but sessions will be held in the City Auditorium.

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The treasurer's report indicated the excellent financial condition of the A.V.M.A. At the close of business on June 30, 1954, the total assets were $197,815.76. Of this amount $59,376.78 are assets of the Research Trust Fund and $138,438.98 in various funds. The total assets increased $28,757.25 during the past fiscal year.

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Listeriosis is probably world-wide in its distribution and almost any type of animal may be expected to harbor responsible organisms.—*Carl Olson, D.V.M.*

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Ionizing radiation is capable of destroying bacteria, parasites, and enzymes in food and may thus become useful for food preservation.

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Atrophic rhinitis is an infectious disease readily established in susceptible pigs by intranasal instillation of crude washings from the nasal cavity of infected swine.—*W. P. Switzer, D.V.M.*

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Hemorrhagic enterotoxemia apparently caused by the beta toxin of *Clostridium perfringens* type C, has been observed in newborn calves and lambs in a number of midwestern states.—*L. A. Griner, D.V.M.*

Commercial Exhibits

Over 50 commercial concerns were represented in assigned locations in the Exhibit Room. All displays had educational value and attracted interested crowds during recesses. New developments in equipment and therapeutic agents were featured in these attractive, well-lighted pieces that were prepared to inform briefly, yet explicitly. Much credit is due those who prepared these fine displays and to those who manned them, assisting practitioners to keep abreast of technical developments.

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Closed circuit television equipment employed for this meeting weighed 17,000 lb. It was shipped to Seattle from Camden, New Jersey by the Radio Corporation of America and the Pitman-Moore Co., which donated the service as an educational contribution.

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Dr. L. E. Fisher of Berwyn, Illinois, well-known television commentator and emcee for closed circuit programs for veterinary conventions named the bull calf born by cesarean section backstage in the Metropolitan Theater in Seattle "Sam". Dr. Sam Elmer, Richland Center, Wisconsin demonstrated the surgical technic.

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Visitors too often take for granted that the many things making up a successful, smooth-running convention will receive the attention of those assigned the detail. They sometimes forget that every detail had to be planned, timed, and integrated with the whole. The notable success of the Seattle convention was due largely to the painstaking efforts of the officers of the Committee on Local Arrangements (Dr. E. E. Wegner, general chairman; Dr. P. M. Hinze, vice-general chairman; and Dr. D. W. Clarke, secretary) with many others working with them and charged with various responsibilities. They earned a rousing vote of thanks and appreciation for a job well done.

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Dr. L. A. Griner of Ft. Collins, Colorado, reported vaccination of dams with a newly-developed toxoid has substantially reduced the incidence of hemorrhagic enterotoxemia in newborn calves and lambs.

Threat to Sheep Industry in the West

Blue-tongue in sheep was described by Dr. Blaine McGowan and Dr. D. G. Kercher, both of California, as the most serious threat ever faced by Western sheep growers. It was pointed out that mortality losses are significant, but that a greater loss was suffered due to weight declines in infected lambs and poor wool quality of survivors.

New vaccine recently made available has proved efficacious in extensive field tests. Large numbers of sheep were vaccinated in California and other western states this summer. Results of use of this new biological prophylactic agent under practical range conditions will be delayed until the close of the lamb feeding season.

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Mucosal disease has been identified in 73 herds of cattle in Iowa according to report by Dr. F. K. Ramsey. Predominant symptoms were described as an initial sharp rise in temperature to 106 F. followed by a rapid drop to normal, watery diarrhea, emaciation, erosion and ulceration of the nasal muscosa, muzzle, lips, gums, tongue, and oral cavity. Autopsy lesions reveal enteritis and cystic colitis with accompanying marked enlargement of lymph nodes and fatty degeneration of the kidneys.

No causative agent has been isolated or identified. No treatment was recommended. The disease is of especial importance because of its resemblance to rinderpest.

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Canadian Veterinary Medical Association

The sixth annual meeting of the Canadian Veterinary Medical Association convened in Ottawa, Ontario, Canada from Aug. 30 to Sept. 1, 1954.

The secretary-treasurer of this young association reported that the membership was in excess of 1,200 paid-up members, which total would, in all probability, be increased to over 1,300 by year end. The A.V.M.A. was represented by Dr. A. H. Quin who delivered an address on the subject of veterinary public relations. In addition to the National Association, each of nine provinces of the Dominion have active association functions.

Newly-elected officers to serve the C.V.M.A. for the coming year are: Dr. R. McG. Archibald, Truro, N. S., president; Dr. Paul Villeneuve, Joliette, Quebec, vice-president; Dr. Orlan Hall, Ottawa, Ont., secretary-treasurer; Dr. Claude Kealy, Ottawa, Ont., executive secretary.

Dr. A. H. Quin, president A.V.M.A. (1) visits with officials of the Canadian Veterinary Medical Association (l to r) Dr. R. McG. Archibald, Truro, N. S., president; Dr. T. Lloyd Jones, principal, Ontario Veterinary College, Guelph; and Dr. Joseph Dufresne, St. Hyacinthe, Quebec, immediate past-president.

Kansas City Cooks Its Garbage and Feeds Its Hogs

DONALD C. LEACH, Kansas City, Missouri

The constant threat of another outbreak of vesicular exanthema has put the city of Kansas City, Mo. in the hog feeding business. This force of circumstance has fostered the development of one of the finest garbage cooking plants to be found anywhere in the United States.

The present program stemmed, originally, from an experiment in cooking garbage started at the Kansas City Municipal Farm about 1941. The plan was successful from the beginning but expansion and development of it was intensified after the 1952 vesicular exanthema outbreak, which resulted in the city reassuming its own garbage collection and disposal. Garbage cooking laws passed in Missouri and many other states, at that time, found Kansas City already well experienced in such procedures.

The moderate hog feeding operation was transferred from the Municipal Farm to a new, more centrally located, site near the stockyards. The number of hogs was increased considerably and a program of breeding and raising its own pigs for the project was undertaken by the city, under the direction of Dr. Hayes Richardson, director of the Department of Welfare.

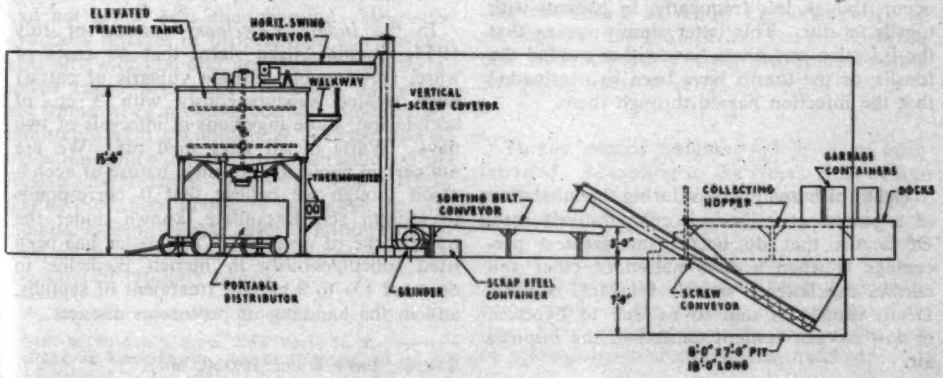
By the time Kansas City's program attains its maximum function, approximately 9,600 hogs will be fed and sold each year, largely offsetting the cost of operation of the project, including the garbage collection.

The new cooking plant, of semi-portable type, is adequate to process 14,000 tons of commercial garbage collected each year. Only commercial garbage is used because of its high food value; that is, it is collected daily and received in better condition than residential garbage.

In viewing the new plant, one is immediately impressed with the extraordinary cleanliness of the entire premises and equipment. This feature was of prime consideration in design and is thoroughly carried out, as exemplified by the use of metals, especially stainless steel, wherever possible, throughout the plant. As illustrated in the accompanying diagram, collection trucks dump the garbage into the raw garbage hopper, from where it is lifted by a screw conveyor onto a 15-foot, neoprene conveyor belt. While moving along this belt, the garbage is sorted manually and pieces of glass, metal, et cetera are removed. At the end of the conveyor, an 8-inch magnetic head pulley attracts all metal objects that can not be sorted. The sorted garbage is then discharged into a universal hammermill where it is ground.

A vertical lift screw elevates the aggregate and deposits it into a horizontal conveyor, mounted on a swivel and distributed, by control, into any one of four 15-ton capacity tanks for cooking. Inside each tank is an electrically powered, three-blade agitator which operates simultaneously with the injection of live steam through four openings in the tank bottom. Thus ample agitation is provided, and uniform heat is distributed during the cooking process. Cooked garbage is discharged through a gate valve at the bottom of each vat directly into waiting tank trucks which distribute it into the hog feeding troughs by means of a chute opening from the rear of the tank truck.

Operational Plan of Garbage Cooking Plant



PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Possible Role of Tonsils in Bulbar Poliomyelitis

Surveys of the comparative frequency of paralytic bulbar poliomyelitis in man in relation to the spinal form, indicate that the former is approximately three or four times as frequent in tonsilectomized cases as in the nontonsillectomized group. In other words, the absence of tonsils appears to be a predisposing factor for the bulbar localization of the virus. One hypothesis advanced for this situation is that at the time of the tonsillectomy the virus may have been in the throat so that it could pass along traumatized nerve fibers into the central nervous system, but this does not explain the greater frequency of the bulbar form in those persons tonsillectomized, in some instances, years previous to the onset of disease.

Anatomically, the tonsils are two almond-shaped bodies situated between the palatal pillars on each side of the fauces. Each is composed of 10 to 18 lymph follicles and is enveloped in mucous membrane. Physiologically, they act as sources of phagocytes for the mouth and pharynx, and serve as filters for the lymph; at least lymph leaving these nodes is richer in lymphocytes than that which enters. To advance another hypothesis for the greater frequency of bulbar poliomyelitis in tonsillectomized persons, the possibility may exist that, following the removal of the tonsils, a defensive filter for invading mouth infections has been removed. It may be advanced that bulbar poliomyelitis does occur, though less frequently, in persons with tonsils *in situ*. This latter simply means that the infective organisms have either evaded the tonsils, or the tonsils have been so overloaded that the infection passed through them.

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Death of human beings during the inhalation of a general anaesthetic is comparatively rare. Of deaths that do occur, the greatest percentage is when a combination of ether and curare, the latter a muscle relaxant, is used. Death usually is said to be due to hypoxia, or low oxygen content tension in the inspired air.

Grass Tetany

One of the frequent deficiencies observed in so-called poisoning following a roughage ration of growing wheat (before it has jointed) is a lowered blood serum magnesium level, a hypomagnesia. This is especially true when the green wheat plant is the sole ration. In test feeding of cattle with rapidly growing grazing feed, and without supplementary feed, hypomagnesium was a complication. When the cattle were given as much as 20 lb. of hay daily, sometimes hay and cabbage, the initial stages of the magnesium deficiency, prior to symptoms of tetany, were overcome so that in a few days blood serum level of magnesium was again in a safe zone.—From report by Inglis, Weipers and Marr in *The Veterinary Record*, June 1954.

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Treatment for Foot-Rot in Sheep

Stewart in the *Australian Veterinary Journal*, July 1954, reports on the treatment of foot-rot in sheep by means of various agents including antibiotics. The best results followed the topical application of 10% solution of chloromycetin® in propylene glycol or in methylated spirits applied by means of a 1 in. paint brush. In field trials, 77% of 17 affected feet were cured by one treatment and the remainder by two applications. Preliminary paring was resorted to in the most severe cases.

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Treatment for Warts

In the *Indian Veterinary Journal* of July 1954, Ananta Misba states that 48 cases of warts (presumably verruca vulgaris of cattle) were treated subcutaneously with 3 cc. of acetylarson; three injections at intervals of two days. Warts of all sizes shed off. We are not certain about the chemical nature of acetylarson though we believe that it corresponds to sodium acetylarsanilate, known under the trade name of arsacetin. This latter has been used subcutaneously in human medicine in doses of 1½ to 9 gr., for treatment of syphilis, and in the handling of protozoan diseases.

®Parke, Davis & Co., Detroit, Mich.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Diseases of Ducks

For those who are interested in duck diseases, I can recommend a review on this subject presented by Dr. E. Dougherty, director, New York State Veterinary College Research Laboratory, Eastport, N. Y. at the 90th annual meeting of the A.V.M.A. (Proceedings Book, page 359). The review briefly describes a number of the diseases common to ducks and is supported by a list of 66 references. Included are the following: Duck virus hepatitis, duck plague, anatipestifer infection, salmonellosis, fowl cholera, erysipelas, tuberculosis, aspergillosis, coccidiosis, external and internal parasitic diseases, poisoning and vitamin deficiencies.

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Dr. D. S. Fleming, Minnesota Department of Health, reported eight cases of salmonellosis in children following the 1954 Easter season. At least seven of these were traced to possible contact with baby chicks distributed for the Easter trade by a super-market. Chicks from two of the homes were demonstrated to be infected with *S. typhimurium*, which was also the cause of the illness in the children. (*Morbitity and Mortality Weekly Rpts.*, U. S. Public Health Service, May 21, 1954.

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Fraps and Case (*Proc. Soc. Exp. Biol. and Med.*, 82:167, 1953) found that the administration of certain barbiturates caused premature ovulation in domestic fowl. According to the authors, ovulation occurred prematurely in a significant proportion of hens following administration of some barbiturates (dial,[®1] ipral[®2] and nembutal[®3]), rarely with barbital, and not at all with phenobarbital. Near-subovulatory dosages of progesterone acted synergistically with dial and nembutal, which themselves cause premature ovulation, an effect not found when progesterone was similarly administered with phenobarbital. Prematurity of ovulation following the administration of effective barbituartes probably results from neural excitation secondary to depression, excitation causing release, over a humoral pathway, of ovulation-inducing gonadotropin from the anterior pituitary body.

[®1]Ciba Pharmaceutical Products, Inc., Summit, N. J.
[®2]E. R. Squibb & Sons, New York, N. Y.
[®3]Abbott Laboratories, North Chicago, Ill.

Interval for Artificial Insemination of Turkey Hens

Research by Smith (Mass. Ag. Expt. Sta. Bul 467) indicates that a turkey breeder can use an interval as great as four weeks between artificial insemination of his turkey hens. The average duration of fertility after artificial inseminations for a flock of 48 Jersey Buff hens was 47½ days. Hatchability was not affected for five weeks, and average fertility was over 90% for 30 days after artificial insemination.

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Dr. George D. Quigley, University of Maryland has warned poultrymen to go easy on deep litter in summer (*Poultry Tribune*, July, 1954). He reports that the surface temperatures of built-up litter may be as much as 7.9 degrees warmer than at the surface of litter 1½ to 2 in. deep. An average of 4.6 degrees difference occurred between the temperature of three-year-old built up litter and thin litter.

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The body temperature of the day-old chick is about three degrees below that of the adult, but by the time it is ten days of age, it is about the same. Chickens, like mammals, exhibit diurnal variation in body temperature. The body temperature of the adult chicken is lowest at 12 midnight and highest at 5 p.m. according to references quoted by Sturkie.

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According to the Department of Agricultural Economics, Cornell University, the estimated cost of raising a White Leghorn pullet to maturity in 1954 is $2.20. For heavy breeds the cost is $2.41. These costs are approximately 3% higher than in 1953.

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Turkey capons weighing 60 lb. have been reported. According to the North Dakota Experiment Station turkey capons are seldom profitable.

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Observations on the inheritance of plumage color, made at the Ontario Agricultural College, have made it possible to tell the sex of goslings by their color when hatched.

Further Observations on the Efficacy of Cadmium Anthranilate as an Ascaricide in Swine

JAMES E. GUTHRIE,* D.V.M., Ashland, Ohio

The value of cadmium anthranilate for the removal of *Ascaris lumbricoides* from swine was reported earlier[1]. These observations indicated that a concentration of 0.066% of the drug administered in the feed for a period of 72 hours removed a high percentage of ascarids from infected pigs. Examination of the data in the preliminary experimental work suggested that a lower level of the drug should be investigated.

Accordingly, a series of five critical experiments were conducted on 54 parasitized pigs, using a concentration of 0.044% of the new ascaricide in a complete feed. These data are presented in Table 1. The medicated ration was fed free-choice over a period of 72 hours. Otherwise the method of conducting the tests was as previously described.

The seven pigs in experiment one were suffering from a respiratory infection at the time of treatment. Temperatures were elevated and considerable coughing and thumping was evident. Three had died prior to the start of treatment and, at necropsy, both lungs were almost completely consolidated. Feed consumption was considerably reduced during treatment period and for about five days thereafter, which accounts for the reduced weight gain. A total of 105 of the 116 ascarids harbored were eliminated following treatment, for an efficacy of 90.8%.

In the second experiment, 93% of 216 ascarids were eliminated from 13 pigs. These pigs made an average daily gain of 1.13 lb. per day for the two-week period from inception of treatment to necropsy.

In the third experiment, 93% of 233 ascarids were removed from 11 pigs. The average daily gain for each animal in this lot was 1.06 lb. for the 14-day period.

In the fourth experiment, 96% of 174 ascarids were removed from 11 pigs. Each pig in this experiment gained an average of 1.77 lb. per day from treatment to necropsy.

In the fifth experiment, 95% of 173 ascarids were removed from 12 animals, each of which made an average daily gain of 1.8 lb. during the 14 days from treatment to necropsy.

Summary

Cadmium anthranilate was administered at a concentration of 0.044% in a complete ration to 54 parasitized pigs over a 72-hour period. Of a total of 912 ascarids present, 857 were eliminated following treatment for an average efficacy of 93.9%.

REFERENCE

1. Guthrie, J. E., Critical Tests with Cadmium Anthranilate as an Ascaricide in Swine. *Vet Med.*, 49:413 (Oct.), 1954.

*Dr. Hess & Clark, Inc. The technical assistance of Grethel Feiber and Clair Eshelman is gratefully acknowledged.

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Increasing care was recommended by Dr. S. F. Scheidy, Dr. J. H. Mash, and Dr. J. F. Skelly in the selection of an antibiotic for the treatment of diseases of small animals. Sensitivity and bacterial tests were suggested for determining which agent would likely be most successful in combatting specific infectious processes.

TABLE 1. Efficacy of a 3-Day Treatment with 0.044% Cadmium Anthranilate in the Feed for Removal of Ascaris lumbricoides from Swine

Note: All pigs were necropsied 14 days following inception of treatment.

Exp. No.	No. Pigs	Mean Weight at Treat. (lb.)	Mean Weight at Necropsy (lb.)	Mean Gain in Weight 14 Days (lb.)	Total Worms Eliminated	Total Worms at Necropsy	Efficacy of Treatment (%)
1	7	57.8	68.7	0.778	105	11	90.5
2	13	42.4	58.3	1.13	201	15	94.9
3	11	58.2	73.09	1.06	218	15	93.5
4	11	77.0	101.9	1.77	168	6	96.5
5	12	107.1	132.4	1.80	165	8	95.3

Magnesium Sulfate Poisoning in a Cow

W. P. BLAKE, D.V.M., Columbia, Missouri

In making a routine, ambulatory call for the Veterinary Clinic at the University of Missouri, we were confronted with a Holstein cow that was down. This animal, with other cattle of the herd, was in a drought-burned pasture which is the rule rather than the exception in this section this year. The cow appeared to be blind and made no effort to get up when approached. Respirations were shallow and slow, and temperature was 104.4 F. (Atmospheric temperature at the time was in the upper 90's.)

Toxemia was suspected immediately. The owner stated that the patient calved two weeks previously, with no difficulty, and had been doing well since. Appetite and milk production had been normal. The morning of the day we made the call, mild mastitis was observed in one quarter and the owner had administered 2 lb. of Epsom salts dissolved in approximately one quart of water as a drench.

Treatment was started with 5% dextrose intravenously. After about 500 cc. were given, 400 cc. of a calcium preparation, and about 150 cc. of G.M.T.* solution were added to the remaining 500 cc. dextrose solution.

The animal responded to the treatment in a manner similar to, but more slowly than, the average milk fever case. After intravenous treatment, the cow got up, with difficulty, and walked off with a staggering gait. Attitude and movement differed from the typical case of milk fever. Uneventful recovery followed.

From the history and the results of the treatment, final diagnosis was magnesium sulfate poisoning, due to the absorption of the magnesium from the drench given by the owner.

In reviewing the literature concerning this condition, it was noted that concentrated solutions of magnesium sulfate may not produce purgation, are absorbed, and are poisonous. Marked respiratory depression, together with a curare-like action on the motor end plates in striated muscle, are primary symptoms. The antidotes, according to some authorities, are calcium and eserine[1]. One author warns against using solutions containing more than 6% magnesium sulfate to avoid absorption and poisoning[2]. Rarely does hypnosis occur following an average, oral dose unless there is a failure of renal excretion or, occasionally, an incomplete intestinal obstruction. Huge oral doses of magnesium can be neutralized by injecting a soluble calcium salt to an equal blood concentration[3]. It is possible, in this case, that, had the owner given the salts in a much larger quantity of water, no ill effects would have been noted.

*Haver-Glover Laboratories, Kansas City, Mo.

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Chloroform Anesthesia for Castrating Boars

JOHN W. KENDRICK,* D.V.M., Davis, California

Many methods of castrating boars have been described, some of which are crude and without anesthesia. The use of chloroform is seldom mentioned, and then usually with disfavor. We have used chloroform anesthesia in over 100 cases with only two deaths. One of these was due to an overdose of the anesthetic agent. In castrating swine weighing over 200 lb., the use of an anesthetic agent has several advantages. It permits proper sanitation, proper restraint, and a careful operation, resulting in rapid healing.

The boar is tied by the upper jaw to a solid object, usually a fence post. A four-foot piece of rope is attached to the left front leg with a slip knot. It is passed to the right front leg and made fast with a half hitch. The hind legs are tied in the same manner and an assistant holds the rope ends.

A feed bag is placed over the snout and 20 to 30 cc. of chloroform applied to wet the area around the nostrils. There is reflex closure of the glottis followed by a short period of excitement, then respiration becomes deep and regular. About 12 to 15 such respirations occur before deep anesthesia is reached.

When the animal begins to go down, the assistant pulls the ropes and turns the animal on its back. The rope from the front legs is passed between the hind legs and the rope from the hind legs passed between the front

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legs so that all four legs are pulled together. The assistant holds the ropes to keep the animal on its back so that no tying is necessary.

The scrotum is cleaned with soap and water and dried with cotton. A deep five-inch incision is made into each testicle. The testicles fall out of the tunic, which is then removed by blunt dissection. In older boars, the gubernaculum must be severed with a scalpel. Testicles and tunica vaginalis communi are removed with an emasculator. The pig is able to stand in a few minutes and is placed in clean quarters or on pasture.

This procedure offers several advantages. It is quick, taking only about ten minutes from the time the boar is tied by the nose. The restraint is excellent and the operator can perform a clean, careful, surgical operation. If the boar can be maintained in clean quarters after surgery, healing is rapid, in many instances without scrotal edema. Thus, earlier marketing of the stag is possible.

Chloroform is a safe and efficient anesthetic agent when used in the manner described for this type of porcine surgery. The single death from overdosage occurred when the assistant accidentally poured the chloroform directly into the nostrils.

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Control Measures Recommended for Atrophic Rhinitis

Three measures for control of atrophic rhinitis were suggested by Dr. William P. Switzer, Iowa State College, Ames.

These include: (1) Depopulation of all swine on infected farms and keeping hogs off premises for a period of three to four months, then re-stocking with disease-free stock; (2) farrow sows and keep litters in individual, isolated lots until pigs are weaned, then separate clean and diseased litters; (3) remove baby pigs from sows within 24 hours after feeding and rear them in clean isolated quarters. The last-named program in particular has been the surest, but least practical, method. No disease was evident among 25 litters from herds in which atrophic rhinitis was present at the time of farrowing.

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